

Psychological Bulletin

THE AIRCRAFT PILOT: 5 YEARS OF RESEARCH

A SUMMARY OF OUTCOMES*

MORRIS S. VITELES, CHAIRMAN

Committee on Selection and Training of Aircraft Pilots

In 1939 the Civil Aeronautics Authority (now the Civil Aeronautics Administration) undertook an ambitious program of training civilian pilots. The purpose of this was to make young men and young women air-minded and to prepare the present generation of young people to fly the private and commercial planes of the future. This program, known as the Civilian Pilot Training program, was operated through the universities of the country, making use of already established facilities in the hands of private operators while encouraging others to set up similar facilities.

The first phase of the Civilian Pilot Training program called for instruction of 10,000 pilots, which was quickly expanded to the number of 50,000. Almost simultaneously with the formulation of the program, largely through the efforts of Robert Hinckley, at that time Chairman of the Civil Aeronautics Authority and Dean R. Brimhall, Director of Research, funds were set aside for research on selection and training of civilian aircraft pilots. This was done in the belief that an extended program of civilian pilot training should make use of every possible scientific aid for selecting those most competent to fly; for determining the best methods of training; for the appraisal of flight achievement, and for safe-guarding the adjustment of the pilot. Moreover, it was recognized that this large scale training program provided unusual opportunities for renewing the study of problems related to the human side of aviation which had been initiated during World War I and abandoned almost immediately with the signing of the Armistice.

HISTORY AND OBJECTIVES OF THE COMMITTEE ON SELECTION AND TRAINING OF AIRCRAFT PILOTS

In keeping with the operating philosophy of the Civil Aeronautics Administration, it was decided to undertake such research through existing agencies rather than to build and equip government operated research centers for this purpose. The National Research Council was therefore asked to establish a committee for the administration of research with funds allotted from the budget of the Civil Aeronautics Administration. In seeking the cooperation of the National Research Council, Mr. Hinckley wrote:

It is the desire of the Civil Aeronautics Authority to have the advice of scientific people in the field of psychology and physiology in making these studies. Furthermore, the authority does not want to set up any new research laboratories, or any organization of its own to do so, but desires to use existing facilities at universities. We request, there-

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fore, the assistance of the National Research Council, and ask that a committee be made up of men primarily from the Division of Anthropology and Psychology of the National Research Council to advise us in the procedure, including the best methods of distributing the financial help to the university laboratories at which such work will be done, the selection of the personnel to do the work, and similar problems. (Letter of 9/16/39.)

On the basis of this request, in the fall of 1939, the National Research Council appointed the Committee on Selection and Training of Civilian Aircraft Pilots (now the Committee on Selection and Training of Aircraft Pilots—CSTAP) including in its membership psychologists, physicians, physiologists, engineers, pilots, and representatives from the military services.

The present membership of the Committee* (June 30, 1945) includes M. S. Viteles, Ph.D., *Professor of Psychology, University of Pennsylvania, Chairman*; Commodore J. C. Adams, (M.D.), *Chief, Division of Aviation Medicine, Bureau of Medicine and Surgery, U. S. Navy*; E. C. Andrus, M.D., *Chairman, Committee on Medical Problems in Civil Aviation, National Research Council*; Conrad Berens, M.D., *Director, Ophthalmological Foundation, Inc.*; H. R. Bohlman, M.D., *CAA Medical Examiner*; C. W. Bray, Ph.D., *Associate Professor of Psychology, Princeton University*; Technical Aide, NDRC Applied Psychology Panel; D. R. Brimhall, Ph.D., *Director of Research, Civil Aeronautics Administration*; Leonard Carmichael, Ph.D., *President, Tufts College*; *Chairman, Division of Anthropology and Psychology, National Research Council*; Cdr. J. W. Dunlap, (Ph.D.), *Aviation Psychology Branch, Division of Aviation Medicine, Bureau of Medicine and Surgery, U. S. Navy*; *Director of Research, CSTAP, 1941-42*; Col. J. C. Flanagan, (Ph.D.), *Chief, Psychological Branch, Office of Air Surgeon, Hdqs., AAF*; F. Fremont-Smith, M.D., *Director, Medical Division, Macy Foundation*; Maj. Gen. D. N. W. Grant, (M.D.), *Air Surgeon, Hdqs., AAF*; J. C. Hunsaker, Sc.D., *Head, Department of Mechanical Engineering and Department of Aeronautical Engineering, Massachusetts Institute of Technology*; Cdr. J. G. Jenkins, (Ph.D.), *Head, Aviation Psychology Branch, Division of Aviation Medicine, Bureau of Medicine and Surgery, U. S. Navy*; *Chairman, CSTAP, 1939-40, 1941*; *Director of Research, CSTAP, 1940-41*; H. M. Johnson, Ph.D., *Professor of Psychology, Tulane University*; Capt. W. E. Kellum, (M.D.), *Division of Aviation Medicine, Bureau of Medicine and Surgery, U. S. Navy*; H. S. Liddell, Ph.D., *Professor of Psychology, Cornell University*; *Chairman, CSTAP, 1940-41*; Brig. Gen. J. F. McBlain, *Army Air Forces*; W. R. Miles, Ph.D., *Professor of Psychology, School of Medicine, Yale University*; Brian O'Brien, Ph.D., *Professor of Physiological Optics, Director of the Institute of Optics, University of Rochester*; P. J. Rulon, Ph.D., *Professor of Education, Acting Dean, Graduate School of Education, Harvard University*; C. L. Shartle, Ph.D., *Professor of Psychology, Ohio State University*; L. B. Tuckerman, Ph.D., *Division of Mechanics and Sound, U. S. Bureau of Standards*; A. D. Tuttle, M.D., *Chief Medical Inspector, United Air Lines*; G. R. Wendt, Ph.D., *Professor of Psychology, Head, Department of Psychology, University of Rochester*. The following were also members of the Committee sometime during the past five years: Commander D. J. Brimm, *U. S. Navy*; Dr. Alexander Forbes, *Harvard University*; C. E. Guthe, *Division of Anthropology and Psychology, National Research Council, (ex officio)*; Commander Eric Liljencrantz, *U. S. Navy*; Dr. R. A. McFarland, *Harvard University*; Captain G. R. Murray, *U. S. Navy*; and L. Povey, *Chief Pilot Inspector, Civil Aeronautics Administration*.

Through an active Executive Subcommittee this group has for over five years conducted research at approximately 40 universities and other centers,

* Members of the Executive Subcommittee are: M. S. Viteles, Chairman; E. C. Andrus, C. W. Bray, D. R. Brimhall, Leonard Carmichael, J. W. Dunlap, J. C. Flanagan, H. M. Johnson, W. E. Kellum, W. R. Miles, P. J. Rulon, and G. R. Wendt.

including military establishments, scattered from coast to coast and from the Lakes to the Gulf under grants from the Civil Aeronautics Administration amounting to approximately \$900,000.* The program has utilized not alone the skills of research men and resources of these universities where basic research projects were established, but has enjoyed the help of hundreds of other men and women and has made use of the facilities of almost 600 other centers participating in the activities of the Committee on Selection and Training of Aircraft Pilots. Research returns have been greatly extended through the contribution of such services and facilities by universities and other centers cooperating in the research program organized and supervised by the Committee on Selection and Training of Aircraft Pilots.

In general, the operation of the Committee on Selection and Training of Aircraft Pilots (Exhibit 1) represents a striking example of research supported by a Federal agency which has allowed a unique amount of freedom from administrative restrictions while providing continuous stimulation and judicious oversight. For this, special credit is due to Dean R. Brimhall, Director of Research, Civil Aeronautics Administration. In addition, acknowledgment is owed to members of the Executive Subcommittee, a group of highly competent scientists who have given freely of their time and of their skill in planning and directing the research program, and to the project directors who administered the research activities. The outcomes summarized in the attached report truly represent the cooperative achievements of scientists, practical pilots, and administrators (both civilian and military) utilizing the resources and facilities of government and private agencies in the interest of the aircraft pilot.

AN ANALYSIS OF RESEARCH OUTCOMES

Plans for research were initiated in the fall of 1939 immediately after the appointment of the Committee on Selection and Training of Aircraft Pilots.

* Cooperating research centers and project directors include: *University of Alabama*, C. P. Seitz; *Brooklyn College*, H. A. Witkin; *Brown University*, Carl Pfaffmann; *University of California*, Berkeley, Calif., E. E. Ghiselli; *University of California*, Los Angeles, Calif., R. M. Dorcus; *University of Colorado*, T. W. Howells; *Cornell University*, H. S. Liddell, Richard Parmenter, A. L. Winsor; *George Washington University*, J. P. Foley, Thelma Hunt; *Harvard University*, R. A. McFarland; *University of Illinois*, T. W. Harrell; *University of Indiana*, W. N. Kellogg; *Iowa State College*, J. E. Evans; *State University of Iowa*, C. E. Buxton, K. W. Spence, Don Lewis; *University of Kansas City*, Lorenz Misbach; *University of Maryland*, R. M. Bellows, J. G. Jenkins, J. W. Macmillan, A. C. Williams; *Massachusetts General Hospital*, Stanley Cobb, J. E. Finesinger; *Massachusetts Institute of Technology*, C. S. Draper, Walter McKay; *University of Michigan*, E. B. Greene; *University of Minnesota*, M. A. Tinker; *Naval Air Station*, Pensacola, Fla., R. A. McFarland; *New York University*, Raymond Franzen, D. H. Fryer; *New York Psychiatric Institute*, Carney Landis; *University of North Carolina*, F. N. Low, Dorothy Rethlingshafer, R. J. Wherry; *Northwestern University*, A. R. Gilliland; *Ohio State University*, H. A. Edgerton, R. Y. Walker; *Pennsylvania State College*, W. M. Lepley; *University of Pennsylvania*, M. S. Viteles; *Purdue University*, E. L. Kelly, Joseph Tiffin; *University of Rochester*, J. W. Dunlap, Brian O'Brien, H. S. Odert, J. D. Page, M. J. Wantman; *Springfield College*, Leonard Larson; *Stanford University*, J. K. Lewis, Eric Liljencrantz, E. K. Strong, Craig Taylor; *University of Tennessee*, R. Y. Walker; *Tulane University*, H. M. Johnson; *University of Utah*, M. W. Lund; *Vanderbilt University*, N. L. Munn; *University of Virginia*, F. A. Geldard; *Wesleyan University*, G. R. Wendt; *Williams College*, Stanley Cobb, J. E. Finesinger; and *Yale University*, W. R. Miles.

NATIONAL RESEARCH COUNCIL COMMITTEE...
on selection and training of Aircraft Pilots.

FLOW CHART OF 1943-44 PROJECTS

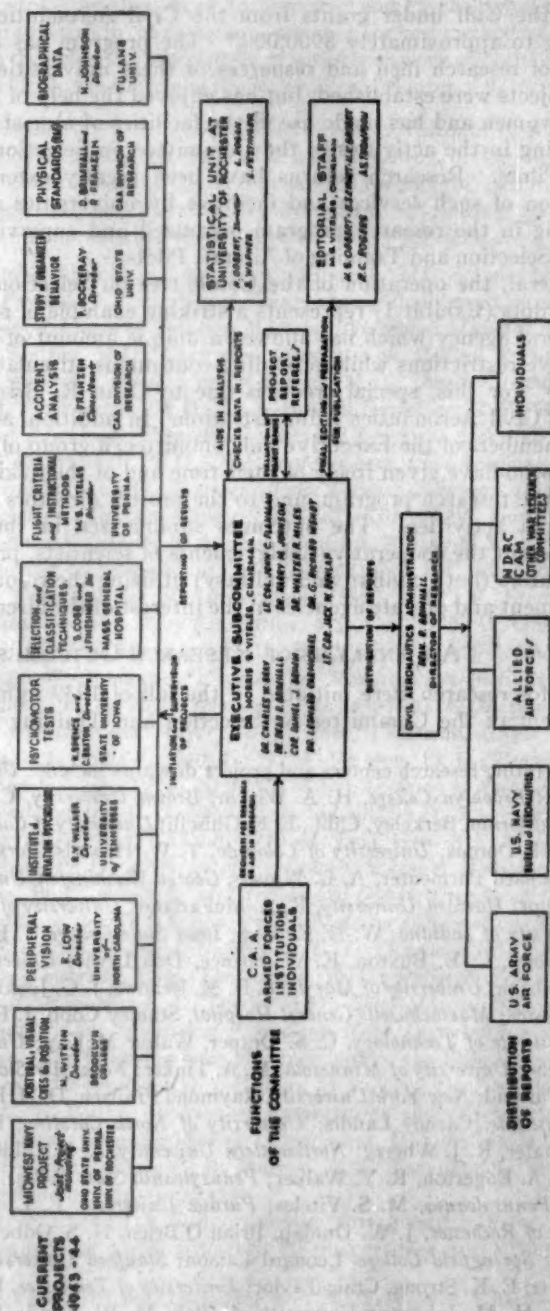


EXHIBIT 1. COMMITTEE ON SELECTION AND TRAINING OF AIRCRAFT PILOTS, NATIONAL RESEARCH COUNCIL

* For

Active research was started early in 1940. The outcomes of research have been summarized from time to time, particularly in the annual reports by the Chairman to the National Research Council and to the Civil Aeronautics Administration.* The present report is devoted to an over-all review of the Committee research program for the 5-year period, 1940-44, inclusive. It is designed to help in evaluating:

1. the effectiveness with which the research program has been conducted;
2. the contributions which it has made to the progress of aviation;
3. the respects in which anticipated outcomes have not been achieved.

In considering this review it should be borne in mind that the Committee was originally organized to undertake research in the selection, training, and maintenance of *civilian* pilots, and that it was first known as the Committee on Selection and Training of Civilian Aircraft Pilots. The functions of the Committee were early expanded to include military as well as civilian aviation and, in 1940, its name was changed to Committee on Selection and Training of Aircraft Pilots, with the specific purpose of formally recognizing the closer integration of the research program with the growing needs of the military services.

For approximately four years, military needs were given primary consideration in the deliberations of the Committee and in planning research programs. This emphasis will undoubtedly be maintained so long as the Committee can continue to be of service to the air forces of the United States and of the Allies to whom research findings have been made available. Nevertheless, as Dean R. Brimhall, Director, Division of Research, Civil Aeronautics Administration, points out in the following quotation from an address given at the 1944 Annual Meeting of the Committee on Selection and Training of Aircraft Pilots, many of the outcomes found useful by the military services can be of very practical value in civilian aviation:

The CAA-NRC Committee pioneer efforts acquainted a fair-sized group of research people with aviation problems. When the war reached the United States many of our workers joined the services to continue their research and the choice of projects to be carried out by the Committee was thereafter determined by the possible contribution of the research to the war effort.

Whatever may be the particular patterns of future projects, supported by the CAA-NRC Committee, this same criterion will be used until the war needs are met. Of course, this does not mean that our current findings will not have application to civilian aviation now and in the post-war period. Selection tests devised to pick out good fighter pilots may be of little use for peace time, but selection for aptitudes such as acquisition of motor skill and the presence of desirable personality and physical qualifications will always be useful.

Increased knowledge in the field of pilot training and maintenance of physical and mental well-being of pilots are certainly useful during peace time as well as during war. So, much of what we learned during war can become immediately useful during peace.

It may be reasonably anticipated that research results will find wider application in civilian aviation as World War II comes to a close, and as such additional steps as are needed are taken to integrate the findings and conclusions of the research program with the operating ends and operating program of the Civil Aeronautics Administration.

* Formerly known as the Civil Aeronautics Authority.

A major objective of the Committee on Selection and Training of Aircraft Pilots and of the Civil Aeronautics Administration is the wide application of research results. This review is written chiefly for the purpose of bringing into focus the useful outcomes of research. In this connection, it should be pointed out that, in some instances, the useful outcomes were in the form of negative findings which perhaps helped to avoid the imposition upon the military services and upon the CAA of costly and cumbersome procedures which would drain available resources without adequate return.

As might be expected, not all of the research activities and investments have been productive of useful outcomes. In some instances, it was found impossible or impracticable to follow up promising leads and thereby to bring potential outcomes to full fruition. In other cases, situations beyond the control of the research project director, such as the unavailability of criterion data, or sudden changes in training plans made by governmental or other agencies, produced insuperable handicaps to the attainment of research objectives. In still other instances, the original experimental design, apparatus, administrative procedures or methods of analysis were inadequate for solving the problem under investigation. There are also projects which have failed either to turn in any final report or to provide a report of the type from which it is possible to evaluate the research findings and the possibility of applying them to meet the needs of military and civilian aviation.

In this review attention is focused upon useful outcomes. Nevertheless, it seems proper, in order to provide a basis for a complete evaluation of the research program, also to include references to those projects which have not made an appreciable contribution to the improvement either of research or of operating procedures.

PILOT SELECTION AND CLASSIFICATION

In the research program of the Committee on Selection and Training of Aircraft Pilots, considerable attention has been given to problems of pilot selection and classification. This was particularly true during the first few years of research, when the country was faced with the problem of building up a large force of pilots for both civilian and military aviation. Moreover, while the emphasis during the past few years has shifted to other areas, particularly to research in pilot training, current investigations are still concerned with problems of selection.

Research on selection has ranged from exploratory studies involving a large number of psychological and physiological tests to the detailed analysis of specific predictors. Practical outcomes have included:

1. the validation of a number of predictors for use in both military and civilian aviation;
2. the accumulation of data on predictors which, although not fully validated, represent promising instruments for further research and application;
3. the identification of tests and other techniques which, while having apparent face validity or originally recommended for other reasons, proved upon investigation to lack reliability or validity;
4. the identification of predictors which, although valid, represent uneconomical techniques for the selection and classification of pilots.

General Outcomes of Research on Pilot Selection and Classification

Contributions to Military Aviation. One major practical outcome of the Committee research program is the fact that by 1941, when the United States

entered the war, the research program had already produced test material and findings which were used by the U. S. Navy in setting up procedures for the selection of pilots. At the Annual Meeting of the Committee on Selection and Training of Aircraft Pilots, held in 1943, Cdr. (then Lt. Cdr.) J. G. Jenkins, in discussing the Navy research program, reported that

We are now using in routine selection, both before and after the beginning of training, three tests. Those three tests were either developed by the Committee first of all as selective agencies in aviation, or were developed by the collaborative efforts of the Committee and the Navy.

The selection program of the Army Air Forces has also profited from Committee research. Reference to this fact is found in the following quotation from an address given by Col. (then Lt. Col.) John C. Flanagan at the 1943 Annual Meeting of the Committee on Selection and Training of Aircraft Pilots:

We have learned a great deal from the work of the Committee. Much of our original planning was based on what the Committee had done, and in the past two years we have continued to profit. . . . Our program, set up two years ago in December of 1941, was built on what we could find out about what the English and the Canadians had done, and the considerable amount of work which had been done by the Committee here.

CAA-National Testing Service. Within the Civil Aeronautics Administration, the work of the Committee on Selection and Training of Aircraft Pilots in pilot selection found its most direct practical expression in the establishment of a National Testing Service (1942-43).^{*} The National Testing Service (133, 137, 138, 139) was designed to provide uniform administration and scoring, on a nation wide basis, of tests for screening candidates for training in the Army phase of the Civilian Pilot Training program. Through this service, centralized at the University of Rochester, 67,067 candidates for pilot training, reporting to 571 coordinators scattered throughout the United States, were tested by 609 cooperating examiners. The administrative cost of this program was borne by the Civil Aeronautics Administration through a special contract at a cost of approximately \$75,000. This means that the Committee conducted screening at the extremely low cost of a little more than one dollar per candidate.

In passing, it should be noted that the CAA-National Testing Service exemplifies the close integration between military and civilian applications in the work of the Committee on Selection and Training of Aircraft Pilots, since results of experimentation by the U. S. Navy were considered in the selection of tests for the screening program and in setting the cutting scores on each test. Moreover, this practical screening program has further reinforced the research program of the Committee in providing data on the extent to which the tests predict differential performance of those who meet minimum standards, and in furnishing significant findings on interrelationships among the tests (133), on differences among applicants for primary, secondary, and glider training (139), and on the influence of such factors as education, age, geographical area, etc., upon selection and upon achievement in learning to fly (133).

Specific Outcomes of Research on Pilot Selection and Classification

The broad, practical outcomes of Committee research in pilot selection and classification have been presented above. Detailed outcomes will be outlined

^{*} Throughout this report the dates in parentheses represent the years in which funds were made available to the research activity.

in the form of a brief discussion of specific areas of research, of individual predictors, and of their usefulness in the selection and classification of military and civilian pilots.

Inventory of Personal Data for Prospective Pilots. This test, generally known as the Biographical Inventory (B.I.), was the immediate outgrowth of work done (38, 43, 66, 106) at Purdue University (1939-40), although investigations at the Naval Air Station, Pensacola, Florida; at Tulane University (1940-41) and at the University of North Carolina also included the analysis of biographical data (36).

The Biographical Inventory (B.I.) represents one of the first, if not the first, successful attempt to predict pilot proficiency from biographical data. Besides serving as one of the basic instruments in the aviation cadet selection program of the U. S. Navy, the Biographical Inventory (B.I.) has also provided items for similar tests employed in the Army Air Forces.

The Biographical Inventory (B.I.) was also used to advantage in the CAA-National Testing Service (66, 106, 133, 137, 138, 139) and in the Standard Testing Program (1942), an extended research project involving the voluntary cooperation of 46 psychologists, scattered throughout the country, in the validation of a basic battery of predictors.

General Intelligence Test. A large scale study conducted in cooperation with the U. S. Navy at the Naval Air Station, Pensacola, Florida (1940-41) indicated the value of using a standard intelligence test in pilot selection (26, 57). Such a test was used by the Navy until it was replaced by the Aviation Classification Test. Because of the nature of both Committee and Navy research results, the test was included in the screening battery used by the CAA-National Testing Service (133, 137, 138, 139). The test is now in use in matching candidates for training in the current research program of the Institute of Aviation Psychology, University of Tennessee, established in 1943 through the cooperation of the Civil Aeronautics Administration, the National Research Council Committee on Selection and Training of Aircraft Pilots, and the Bureau of Aeronautics, State of Tennessee.

Aviation Classification Test. Items for this test were prepared by the U. S. Navy. Work on item analysis, on construction of alternate forms, and on determining the reliability of the test was carried on as a research project of the Committee on Selection and Training of Aircraft Pilots (1942) at the University of Rochester. The test was later incorporated by the Navy into the Navy pilot selection battery.

Mechanical Comprehension Test. The Mechanical Comprehension Test was included in research conducted in the Midwest Project (1941-42), in the Boston Project at Harvard University (1941-42), and also in the Standard Testing Program. Prior to the completion of these studies, this test was included in the battery used by the CAA-National Testing Service on the basis of experimental findings provided by the U. S. Navy. Results available from the Midwest and Boston studies provided evidence on the usefulness of this test for initial selection (65, 104, 115). The analysis of CAA-National Testing Service data has furnished interesting information on the relationship of this test to other predictors, as well as to age, geographical area, etc. (133). The Mechanical Comprehension Test is one of the battery employed in matching research groups at the Institute of Aviation Psychology, University of Tennessee.

Psychomotor Tests. The Pensacola Study of Naval Aviators furnished evidence on the value of three psychomotor tests, viz., the Mashburn Serial Action Test (55), the Eye-Hand Coordination Test, and the Two-Hand Coordination Test (56) in differentiating "good" from "poor" pilots, including washouts and

those who had Board appearances (57). The Committee on Selection and Training of Aircraft Pilots cooperated in producing an improved model of the Two-Hand Coordination Test, later adapted for use in the early experimental program of the Army Air Forces, which led to the extended use of psychomotor tests in the classification of Army aircrew personnel. In addition, according to a research report by Lt. Col. A. W. Melton, appearing in the *Journal of Aviation Medicine* (1944, Vol. 15, pp. 116-123), the Rotary Pursuit Test "was originally introduced in the psychomotor classification battery (of the Army Air Forces) on a hunch supported by a bit of data which had come from a study sponsored by the National Research Council Committee on Selection and Training of Aircraft Pilots" (28, 30).

While the number of cases was small, the Midwest Project (91, 93, 96) and the Boston Project (54, 105, 115) of the Committee on Selection and Training of Aircraft Pilots have produced further evidence on the validity of the Mashburn Serial Action Test and of the Two-Hand Coordination Test for pilot selection. These tests are also currently being used in connection with research at the Institute of Aviation Psychology, University of Tennessee.

Productive cooperation with the Army Air Forces is illustrated in service rendered by the Committee staff in connection with a special experimental program for the investigation of psychomotor tests conducted at the University of Rochester and at the University of Buffalo (1943). Studies at the State University of Iowa (1942-44) on the effect of lateral distraction lights on performance on the Mashburn Serial Action Test, conducted in close collaboration with the staff of the School of Aviation Medicine, AAF, have produced results on learning rate and on reliability of performance under differing procedures of administration (63), of practical interest in the Army Air Forces Testing Program. There has also been cooperation with the Army Air Forces on research conducted at the State University of Iowa (1942-44), concerned with the effect of various combinations of work and rest periods on (a) the rate and level of performance, (b) the reliability of scores, and (c) the intercorrelations among scores based on different learning segments for the Rotary Pursuit Test (72) and the Two-Hand Coordination Test (73). In another study, made at the request of the staff of the School of Aviation Medicine, AAF, with the cooperation of the U. S. Navy, attention has been centered on the validation, in relation to learning to fly, of initial, terminal, and segment scores obtained through the administration of a variety of psychomotor tests (4).

In the case of a number of the psychomotor tests referred to above, the Committee on Selection and Training of Aircraft Pilots has also made a practical contribution through improvements in apparatus used in Committee research, in providing drawings and wiring diagrams, and in the standardization of apparatus and procedures for administering the tests (55, 56).

Statistical Developments. Studies sponsored by the Committee on Selection and Training of Aircraft Pilots have also led to the refinement of methods for selecting combinations of predictors and determining the best cut-off points through the use of multiple chi (20). Various memoranda devoted to a discussion of such techniques have been prepared (22, 23, 24) and made available to research workers in both military and civilian aviation. These include an analysis of results obtained from the use of multiple chi as compared with those obtained from use of multiple correlation techniques (114, 118, 120), using results from the Standard Testing Program (107, 108, 111, 112). Interesting statistical developments are also to be found in steps taken for the scoring, analysis and interpretation of physiological data (18, 19, 25, 49).

Physiological Tests. An important practical outcome of Committee research

bears on relationships between physiological measures and pilot performance. Of 21 physiological items included in the Pensacola Study of Naval Aviators, vital capacity and the smallest pulse pressures subsequent to tilt proved to be the only items showing promise in the differentiation of "good" pilots and "poor" pilots, including washouts and Board appearances. Even these measures failed to differentiate the criterion groups at an accepted level of significance (18, 26, 57).

Analysis of the Pensacola data drew attention to the significant fact that the low validity of the physiological tests studied may be a function of low reliability in the sense that the test as administered provided merely a measure of a biological instant not consistently representative of the physiological function extending over a long period of time. Similar findings on unreliability of physiological measures were obtained in other studies at Harvard University (105, 115). Constructive outcomes of such findings appear in the steps which have been taken towards the exhaustive analysis of respiratory measures, with a view to arriving at items that give sufficiently consistent measures to permit their further use in the determination of validity for pilot selection or in the maintenance of pilots (25).*

While many items were included in the studies of physiological measures, independent and extended treatment has been given to the electroencephalogram, somatotypes, visual measures, and to certain cardiovascular functions in investigating the relationships with achievement in learning to fly.

Electroencephalography. Records were obtained in studies (1940-41) at Harvard University (17, Supplement), Massachusetts General Hospital (15) and Naval Air Station, Pensacola, Florida (17, 21, 57). Results were not sufficiently promising to warrant the recommendation that this elaborate technique be included in a pilot selection battery.

Somatotyping. Somatotype measures obtained in the Pensacola Study were subjected to an extended statistical analysis (21, 57). The results showed the need for further investigation and cross validation of somatotyping techniques on less selected populations before the procedures could be recommended for use in the selection of aircraft pilots.

Visual Functions. An analysis of the relationship between visual functions and the achievement of RAF cadets in learning to fly (1941-44) has led to the tentative conclusion that visual deficiencies, such as are accepted by the RAF, are not related to achievement in learning to fly (3). The findings and conclusions are entirely tentative because of the fact that early eliminations were not included in the investigation. The study is now being repeated on another population of RAF cadets which does include early eliminations. The final findings and conclusions will have an important practical outcome in providing experimental evidence as a basis for arriving at decisions with respect to lowering the visual standards in the certification of pilots in this country.†

* It should be noted that the relationships between physiological measures and pilot performance over extended operational periods have not so far been studied in Committee research.

† A further development of research in this area is a recent request from the Civil Aeronautics Administration, at the initiation of the Civil Aeronautics Board, that the Committee on Selection and Training of Aircraft Pilots undertake further studies of the relationship between visual measures and flight performance to provide experimental data of significance in the certification of private pilots.

Physical Fitness. Experiments (1939-42) at Stanford University (75, 76, 77), supplemented by exhaustive statistical analyses, have pointed to the inadequacies of the Schneider Index and to the need for simpler and more reliable measures of physical fitness (19, 24). These studies have been marked by the use of statistical techniques peculiarly applicable to this problem. The results of the investigations were made available to the U. S. Navy for use by this service in connection with a program designed to develop simplified and improved tests of physical fitness. The Committee program has included plans for further work in this area designed to lead to practical results in the formulation of standards for the certification of civilian pilots.

Studies of the Interview. Since considerable emphasis had been placed on the interview as a method of pilot selection, a standardized interview and rating procedure (Exhibit 2) were developed, and extensive investigations of the interview (1941-43) carried out under the auspices of the Committee at Wesleyan University, Harvard University, Ohio State University, Purdue University, and the University of Michigan (8, 116, 121). The economic aspects of research conducted by the Committee are illustrated in the conclusion that the contribution of even a reliable interview appears to be slight in terms of the time, effort, and cost involved in the interview procedure, since it adds little to the predictive information obtained through the use of much less expensive and more easily administered paper-and-pencil tests.

A study of the psychiatric interview used in the Massachusetts General Hospital Project (1940-42) revealed little promise for this particular type of interview (15). However, measures of the interaction between interviewee and interviewer, as recorded on the interaction chronograph, showed promise and this technique has been subjected to further validation in the examination of aviation cadets at Williams College (14), conducted through the cooperation of the U. S. Navy (1943-44).

Among the practical outcomes of Committee research are several new tests and other predictors which, although not fully validated, appear to represent promising materials for future research and possible use. The following may be included in this category.

Test of Aviation Information. This test was developed (1941-43) in the research program of the Committee on Selection and Training of Aircraft Pilots at the University of Rochester (107, 110, 113). Preliminary results on the test were obtained in the Standard Testing Program (108, 109, 111). The test was released to the U. S. Navy for further research and also used by the CAA-National Testing Service for the selection of applicants for flight training. A comparison of the test results with achievement in learning to fly indicates that it can be included among the more promising predictors developed in the Committee's research program (133).

Personal History (P-H) Inventory. This test was originally developed largely through the cooperation of the staffs at the University of Rochester and Wesleyan University (1941-43) for use in connection with the study of the aviation interview (8). Scoring keys, data on reliability, and some preliminary data on validity are available from the Standard Testing Program (46). The test is now being used in connection with research at the Institute of Aviation Psychology.

Desire-to-Fly (D-F) Inventory. This test was developed in research conducted at the University of Rochester (1941-43). Scoring keys and data on validity are available from studies at the University of Rochester (44) and ad-

INTERVIEW CHART		Name of Candidate _____
		Name of Rater _____
25	D. DESIRE TO FLY	
20	AN ARDENT, IMPRESS- IBLE DRIVE TO BE- COME A FLIER	
15	A STRONG INTEREST IN FLYING	
10	A MILD INTEREST IN FLYING	
5	ONLY A SLIGHT INTEREST IN BECOMING A FLIER	
1	NO FUNDAMENTAL INTEREST IN FLYING	
<p>has a very strong and sincere interest in becoming a flier; would rather fly than eat; bubbling over with enthusiasm for flying; knows a lot about flying already; can't wait until he gets in the air; heart is set on flying; has always wanted to fly</p> <p>has a genuine desire to fly; wants very much to fly; has paid for flying instruction; has read widely about aviation</p> <p>would like to be a flier; is an average candidate; has a moderate desire to become a flier</p> <p>is nonchalant about flying as a career; prefers other things to flying; is prompted primarily by money</p> <p>has pseudo-interest in becoming a flier; is a "draft-dodger"; drifted into flying; flying is a means to some other end; is only curious about flying</p>		
EXPLANATION OF RATING:		

EXHIBIT 2. SAMPLE RATING SHEET USED IN THE STUDY OF THE AVIATION INTERVIEW

ditional data are being accumulated through the use of the test at the Institute of Aviation Psychology.

"Ability-to-Take-It" Tests. The investigation (1940-43) of tests designed to measure "ability to take it," conducted at the University of Rochester, Northwestern University, and the University of North Carolina, provided support for the point of view that this is not a unitary trait and produced a number of measures considered sufficiently reliable for use in further research (7, 30, 117, 119). Nine units of one of these tests, a Recording Dynamometer, have been purchased from the Committee on Selection and Training of Aircraft Pilots by the U. S. Navy for use in further research. However, a recent study (1943-44), involving an analysis of examiner differences in testing 550 Naval Aviation cadets at Williams College, has raised serious questions concerning the ultimate usefulness of the "Ability-to-Take-It" Tests (67).

Stability of Orientation Test. This test, developed at Brooklyn College (1942-44), yields a measure of a subject's ability to recognize changes in his lateral and longitudinal position with respect to the earth when the visual cues from his immediate environment are deliberately falsified through tipping or rotating a "room" to a position other than the horizontal (129, 130, 131). The test has been made available for validation by the Army Air Forces (1944). Progress has been made in the validation of this test on approximately 1000 aviation cadets. In addition, this test is being used in a program at Brooklyn College (1944), designed to determine the extent to which improvement in spatial orientation can be effected by training (132).

"Self-Description" Test. Each item in this "personality" test, developed at the University of North Carolina (1939-41), consisted of two descriptive phrases, one of which the subject was required to select as describing him better than the other (124). This arrangement of descriptive terms greatly reduced the subject's chance of inferring the correct answer to individual items, since both descriptive phrases constituting one item were frequently derogatory or commendatory. Preliminary validation data were obtained on Civilian Pilot Training students, but further work is needed to make this a practical addition to a test battery.

Scholastic Grades. Several studies of scholastic grades and flight performance (1940-41) showed little relationship of such grades to achievement in learning to fly (1). Further studies in this area may be of significance in formulating scholastic requirements for civilian pilot training. However, there has been no follow-up in this area of investigation.

Included in Committee research on pilot selection and classification are investigations, undertaken particularly in the early or exploratory phase of the research, which produced generally negative or questionable results in terms of application. Failure to arrive at practical outcomes resulted, in some cases, from the fact that the research projects were intended merely to select predictors for further study. A study (1939-40) of 39 psychological and physiological tests at Purdue University (16), investigations (1939-40) at the University of Alabama (71), and several studies at the University of North Carolina (69, 125, 127) are representative of this group. Moreover, practically all such early investigations were handicapped by limitations of criteria and of size of sample. In other instances, however, as suggested in the Introduction to this report, failure to arrive at practical outcomes can be laid not to the exploratory nature of the research, but, at times, to defects inherent in the nature of the experimental design; at other times, to conditions not subject to control by

the investigator; and, in still other cases, to the fact that the investigators failed to provide adequate reports on the investigations conducted by them.

Work on the development of a key for the *Strong Vocational Interest Blank* for use in pilot selection was initiated (1939-40) under Committee auspices at Stanford University (74), and other studies on this instrument were conducted (1939-40) at Ohio State University (101) and at Purdue University (1939-41). However, such studies have not led to the recommendation that this instrument be used in selection batteries.

The *Humm-Wadsworth Temperament Scale*, *Guilford STDCR Test*, and the *Maslow Dominance Test* were investigated at various research centers, including Northwestern University (1940-43) and Purdue University (1939-40). Preliminary results indicated in general that these tests had little value as predictors of flight proficiency. However, questions regarding scoring procedure, criteria, and analysis of data rendered conclusions equivocal.

Studies of *interest and attitude scales* were conducted at George Washington University (1939), but inadequacies in design rendered it impossible to reach definite conclusions concerning the value of the measures analyzed (16).

Studies of the *Link Trainer (Contact)* as a device for selection and training of pilots were early undertaken at the University of Michigan (1939-41). Later, methods were developed at Harvard University (1941) for obtaining objective records of performance on this trainer, and further studies of the device were undertaken in the Boston Project at Harvard University (1941-42) and in the Midwest Project (1941-42). Preliminary data indicated that the reliability of scores obtained through methods devised in this research was too low to justify the use of the Link Trainer (Contact) for selection purposes (5, 60, 92). In general, findings from such studies proved to be ambiguous because of apparatus and administration difficulties, and, in some instances, because of inadequacies in reports on findings (5).

Apparatus was developed at the University of Colorado (1939) for testing *eye-hand-foot coordination* similar to that required for aircraft operation. Adjustments were required in response to flight situations projected on a screen. However, no data were presented in the report submitted by this project (33).

The *Seashore Serial Reaction Time Test* and the *Ranssen Coordinator* showed some slight promise in early investigations (1940-43) at Northwestern University (30), but further investigation of these instruments was never carried out.

Snoddy Star Test. This test was administered to subjects in the Standard Testing Program (45). While apparently showing some merit, the test has not been included in selection batteries, partly because of difficulties involved in administering the test.

The interrelationships of *cardiovascular-respiratory variables* were studied by factor analysis techniques at Springfield College (1940). Inadequacies in design and statistical treatment have prevented practical applications of this work (49).

Projection Tests. A number of projection tests were employed in a study conducted by the staff of the Massachusetts General Hospital, through the cooperation of the U. S. Navy, at the Naval Air Station, Squantum, Mass. (1940-42). While results on most of these tests (15), including a modification of the Rorschach, were negative, promising findings were obtained on a number of items which have recently been subjected to further study (1943-44), again through the cooperation of the U. S. Navy, in an investigation by the Massachusetts General Hospital group at Williams College (14). Criterion data fur-

nished on approximately 500 subjects are now being subjected to analysis at the University of Rochester.

PILOT TRAINING

During the early years of the Committee on Selection and Training of Aircraft Pilots the major emphasis was on the development of improved methods for the selection and classification of pilots and on associated criterion problems. This emphasis was not only in accord with the needs of the time, but also a natural outcome of the fact that exploratory steps in the selection of pilots had been taken during World War I which provided some basis for immediate practical research by the Committee (134). During the past few years, as the selection situation in the military services became stabilized, the emphasis has shifted from research in selection to research in training. Here the Committee entered a field of investigation which was largely uncharted. As is apparent below, Committee activities in this area represent pioneering efforts which have produced new tools of importance both to civilian and military aviation.

In research on training, the Committee has considered two aspects of the training situation. The first centers around problems experienced by student pilots in learning to fly. Secondly, consideration has been given to the methods employed by instructors in teaching students, since the learning of the student is dependent upon methods used by the instructor. The latter naturally leads into problems of curriculum revision.

Practical outcomes from research in pilot training can be divided into two categories:

1. the development of basic research tools and methods for use in the investigation and improvement of pilot training;
2. the development of training aids for field use.

As might be expected, there is very close interrelation between these two categories since, in some instances, the availability of newly developed tools and methods led directly to practical applications, and in others, the development of new training aids led to further research productive of additional outcomes in the way of improved training methods. Following is a brief analysis of the major practical outcomes of research on pilot training, supplemented by a brief statement concerning incomplete research and areas in which anticipated outcomes have not yet been achieved.

Development of "Patter" and "Fundamentals of Basic Flight Maneuvers." One of the early and extremely fundamental research projects on pilot training was that carried on at Purdue University (1940-42). When Committee research was initiated, little or nothing was known about the nature of actual air instruction, since such instruction was generally conducted in a two-place plane, and student and instructor were in a situation where the instructional process could not be directly observed.

A short-wave transmitter and electrical interphone suitable for use in a light plane were developed. Through the use of these, for the first time in history, elementary flight instruction could be observed, and evaluated, in light of modern scientific and educational principles. By means of this equipment, instruction was transmitted to a receiver on the ground, recorded, and later transcribed. Over 100 hours of instruction, both at Civilian Pilot Training schools and at the Naval Air Station, Glenview, Illinois, were recorded. Qualitative and quantitative studies (10, 11, 41, 42, 78), besides indicating the good points of instruction, revealed many areas in which instruction could be improved.

One immediate outcome of this preliminary research was an opportunity to examine variations among instructors with respect to the vocabulary or terminology used in training pilots. For example, an analysis of 10 hours of instruction by each of 4 instructors revealed a total of 500 technical or specialized terms, many of which were unique to an individual instructor (41). In addition, it was found that (a) much instruction was given in the air which could better have been given on the ground, and (b) pilot training suffered from inadequate methods of presentation by instructors unaware of the fundamentals of good teaching procedures.

PATTER FOR ELEMENTARY MANEUVERS

10. CLIMBING TURNS

C. A. B. No. 5: P. 153

C. A. B. No. 23: P. 61-63

Talk over while gaining altitude. Turns may be executed in the normal and the maximum climb. In both of these, the turn is made with a shallow bank. The only difference is that the normal climb is accomplished with 100 engine R. P. M. above cruising speed, while the maximum climb is accomplished at full throttle, so a slightly greater angle of climb is possible.

Check traffic.

Left climbing turn. We will first do a gentle, 90-degree left climbing turn. First after making sure that there will be no other planes in the way, open the throttle until the engine R. P. M. is approximately 100 R. P. M. above cruising. Then, assume a normal climb as we have done before.

Now, since we know that additional back pressure is needed in a turn, we decrease this angle of climb by approximately one-third. This will provide for the additional lift needed when we are turning.

Point to left wing, Point to nose.

Now we coordinate our controls until our left wing tip is in this relation to the horizon. You can see that it is the same as in a shallow-banked turn. Remember, we must keep the nose in its usual position during the turn.

As in our previous turns, we release our rudder and aileron pressure as soon as the turn is established, then apply slight opposite aileron pressure.

Recover.

When we wish to recover from the turn, we coordinate our controls so as to stop the turn and the bank. At the same time we adjust the back pressure so that by the time we are flying straight we are back in a normal climb. O. K., now you take over and execute a climbing turn to the left.



EXHIBIT 3. SAMPLE PAGE FROM "PATTER FOR ELEMENTARY FLIGHT MANEUVERS"
(Civil Aeronautics Bulletin No. 31)

These findings led first to the development of two training aids of fundamental importance for elementary instruction: (1) *Patter for Elementary Flight Maneuvers*, and (2) *Fundamentals of Basic Flight Maneuvers*.

Patter provides a model presentation of air instructions in basic maneuvers. As pointed out by E. L. Kelly, Project Director at Purdue University, who was largely responsible for the basic work on these and on a number of other aids considered in this report (42):

Behind the preparation of *Patter* was a very strong feeling that a student deserved at least one simple and complete description of each maneuver while in the air, preferably during the first time it was demonstrated to him. Analysis of actual recordings of flight instruction convinced us that such descriptions were not available in the spontaneous instruction given by instructors in the air. It was at this point we decided to prepare appropriate *Patter* for each of the maneuvers.

In the *Fundamentals* were outlined the basic facts which should be understood by the student pilot before going up for instruction in the various maneuvers. These, as in the case of *Patter*, were prepared in light of educational

principles, attention being given particularly to the definition of each new term as it was introduced.

Following many revisions and "flight testing" by experienced instructors, these training aids were presented to the Civil Aeronautics Administration and, following additional modifications by the staff of that agency, were published early in 1943 as *CAA Bulletins No. 31* (Exhibit 3) and *No. 32*, with an initial order of 20,000 copies.

Even before the publication of these materials by CAA, special revisions were prepared by the U. S. Navy with the aid of personnel provided by the Committee on Selection and Training of Aircraft Pilots. Acknowledgment of the manuals prepared for the use of the U. S. Navy by the training staff of the Bureau of Aeronautics, in cooperation with research personnel supplied by the Committee on Selection and Training of Aircraft Pilots, is found in a letter dated July 28, 1942, addressed to the Chairman of the Committee by Capt. (now Admiral) A. W. Radford which states in part:

The flight manual, originally written under the auspices of the National Research Council, has met with unanimous approval by flight personnel who have read the booklet, and it is felt that it will be of inestimable value in furthering flight training.

Among other practical outcomes in this area was a translation of the *Elementary Patter* into Chinese, prepared through the Division of Research, CAA. A preliminary edition of *Patter* and *Fundamentals* for secondary training was also prepared and submitted to the CAA, but this, so far as the records of the Committee show, has not led to CAA publication or use.

Development of Air-borne Model Magnetic Wire Recorder. The Committee deserves considerable credit in connection with the development and promotion of the Air-borne Model Magnetic Wire Recorder in aviation. This instrument was developed largely through the initiative of the Director of Research, CAA, and of the Project Director at Purdue University (1942), the latter serving as a consultant to the Armour Institute of Technology in the design and manufacture of the first model of this instrument (39). Mass production of the Air-borne Model Magnetic Wire Recorder was further stimulated through the efforts of the Division of Research, CAA, working in close cooperation with the Committee.

The Air-borne Model Magnetic Wire Recorder has proven of great value in research by the Committee and, in addition, is used in training activities by the U. S. Navy and the Army Air Forces. It has also become an extremely useful tool in Army and Navy operations through other applications which have apparently very advantageously affected the war effort. In view of the latter it is perhaps significant to note, as apparent from available correspondence, that the Air-borne Model Magnetic Wire Recorder and the possibilities inherent in the instrument were first brought to the attention of the military services, in October, 1942, by the Committee on Selection and Training of Aircraft Pilots through the Civil Aeronautics Administration.

Development of the WTS Methods Training Course. Analysis of flight instruction supported the conclusion that flight instructors should be *good teachers*, as well as *good flyers*, and that existing requirements for instructors, which placed almost complete emphasis on flying ability, were incomplete. The CAA War Training Service, becoming aware of this fact, requested the Committee, early in 1943, to develop a 30-hour course on the theory and techniques of flight instruction as a basic unit in the CAA Controlled Secondary Instructor Course and, in addition, to train selected personnel to give this course at training centers.

Such a course (90) was developed by Committee personnel. It represented an application to flight instruction of the outcomes of educational and industrial research on the learning and teaching processes (136), and of the results of findings from pilot training research conducted by the Committee on Selection and Training of Aircraft Pilots. It undertook to achieve an integration and organization of these established principles and research findings in such a manner as to furnish practical and effective guidance to flight instructors. This was done with a minimum of technical terminology, and with repeated and specific references to the flight situation.

Applying standards formulated by the Committee on Selection and Training of Aircraft Pilots, the Civil Aeronautics Administration selected a group of seven men known as "methods instructors" to take this course at an Institute conducted by Committee personnel at the University of Minnesota in April, 1943. These methods instructors were then assigned to CAA Instructor Training Centers to give instruction in teaching methods to those undergoing training as flight instructors. A second Institute, involving a group of 30 men assigned by CAA, was held at Ohio State University in the fall of 1943. Each man undergoing such instruction was provided with a comprehensive manual entitled *Lesson Plans for Training Methods Unit, CAA-WTS Controlled Secondary Instructor Course* and an Instructor's Kit which was then used as a guide in conducting training and teaching methods at Instructor Training Centers.

The materials for this course were turned over to the Army Air Forces and the U. S. Navy for use in developing similar instructor training programs. Copies have also been made available to the air forces of allied nations. There has been established in this course, and through the experience at the Institute, the basis for important postwar activity in improving the quality of flight instruction of civilian pilots. These materials represent a basic step in raising the level of professional skills, and such a course might well be established as a prerequisite in the licensing of pilot instructors as we move into the extended training of civilian pilots in the postwar era.

Compilation of Instructional "Tricks." Investigations of flight instruction showed the need for eliminating certain inadequacies in the procedures employed. These investigations also revealed that many special teaching techniques actually used by individual instructors in the field were of great value. It therefore seemed desirable to compile those special teaching methods which individual flight instructors had found by experience to be effective in dealing with specific problems of individual trainees and in teaching specific maneuvers. It also seemed well to make provisions for circulating such ideas to instructors throughout the country. For these reasons, a questionnaire was sent (1943-44) to 1000 flight instructors in the WTS Army and Navy programs, requesting each to describe methods he had found particularly useful in overcoming student pilot difficulties. Over 3000 techniques were compiled from replies to the questionnaire (12, 85) returned by approximately 100 flight instructors. These techniques are now being evaluated by civilian and Navy instructors. Upon completion of this evaluation it is intended to prepare a manual which may well become a valuable supplement to available flight instruction manuals. In the meantime a compilation of instructor "tricks," in preliminary form, has been made available to the U. S. Navy, the Army Air Forces, and the Royal Air Force.

The outcomes of the major studies discussed above can be considered positive contributions in the area of pilot training. Equally significant results may be expected from training studies now in progress.

One of the major difficulties encountered in conducting research in training lies in controlling conditions, e.g., selection of student pilots and rigorous control of types of instruction. The establishment of the Institute of Aviation Psychology at the University of Tennessee (1943) through the cooperation of the Committee on Selection and Training of Aircraft Pilots, the Civil Aeronautics Administration, and the State of Tennessee Bureau of Aeronautics was intended, in part, to overcome this difficulty. Here use is being made of the tools and techniques developed in Committee research described above in the investigation of specific problems in training, such as the relative effectiveness of training with and without instruments, variations among age groups in learning to fly, and factors involved in learning to land a plane. Such studies are directed primarily towards problems of civilian aviation, and the findings should be of particular significance for postwar aviation.

In addition to field research on general problems of pilot training, attention has been directed towards basic perceptual processes involved in learning to fly. In this connection, an extensive investigation of peripheral vision has been undertaken at the University of North Carolina (1942-44), centered on the development and evaluation of procedures for the improvement of peripheral visual acuity (51, 52). Another investigation at Brooklyn College (1943-44) has involved the study of methods for training subjects in perception of position, through use of the Stability of Orientation apparatus (132).

Certain other investigations in the area of training, while not resulting in major contributions or immediate practical outcomes, have had some value as exploratory research. Such studies are described below.

Eye Movements and Visual Cues in Landing. The attention of the Committee was early directed by the Director of Research, CAA, to the importance of investigating the role of visual cues in landing a plane. Exploratory work in this area was begun in 1939 at the University of Rochester. This resulted in the development of a photographic instrument suitable for such research and in certain preliminary findings on the patterns of eye movements of experienced and inexperienced pilots, respectively. Research under this project was not completed and no final report is available, but the investigation has served as a stimulus for similar investigations by other groups.

In an investigation at Brown University (1940), provision was made for a detailed introspective account of visual cues used both during flight and in landing, supplemented by an analysis of introspective accounts by other observers (79, Supplement). Initial steps were also taken for the development of photographic equipment and in planning further extended objective studies in this area. These studies were interrupted by the entry of the investigator into the Navy, where he has since conducted similar research. An exploratory study initiated in 1941 at Purdue University, involving the use of photographic equipment, indicated that there were no patterns of eye movements during landing which clearly differentiated experienced from inexperienced pilots although lack of adequate criteria prevented determination of the relationship between eye movements and excellence of landing (79). On the basis of the rather small sample of pilots studied it was suggested that the procedure of instructing the student to look at some specific place, and nowhere else, during landing was inadvisable, particularly since a few experienced pilots, who insisted that there was a proper place to look, actually did not maintain fixation on this suggested area during their own landings.

Studies in Peripheral Vision. An early study at the University of Minnesota (1939-40) attempted to determine the relationships between skill in landing

and disjunctive reaction time to peripherally presented visual stimuli (80). Lack of a clear criterion of landing proficiency represented the major limitation of this report, but the study has merit as an exploratory research.

Air-Ground Time. Early in the work of the Committee on Selection and Training of Aircraft Pilots attention was drawn to the amount of time spent on the ground and in the air, respectively, during flight periods as a possible source of significant variation in the training of aircraft pilots. As a result, in 1940, observations were made of the proportion of flight time spent on the ground and in the air as an incidental feature of larger investigations conducted at the University of Maryland and at Tulane University (135). Subsequently (1941-42), through projects at Kansas City University, Purdue University, and the University of Utah, the Committee initiated a major study (135), designed to provide through the use of a modified Servis Recorder extensive data on differences in the amount of time spent on the ground and in the air and on the influence of such factors as type of airport, instructor, student attitudes, etc. upon such variability.

Perhaps the most immediately important finding of this series of studies was that students undergoing instruction in relatively small private fields, used solely for civilian trainees, spent a significantly greater proportion of time during Stages C and D actually flying than did student pilots training at the large commercial airports. In general, the findings suggested the desirability of making instructors and operators aware of the need for considering special local situations which may result in excessively extending the amount of time spent on the ground during flight training.

In addition to providing such preliminary finding, the studies served to indicate the necessity of more exacting design and of larger samplings of airports, instructors, and students, if it seems desirable to do further work in order to answer with a greater degree of definitiveness the questions asked in initiating these studies on air-ground time.

Analysis of Movements in Handling Controls. In an investigation conducted at the University of Pennsylvania (1939-40) steps were taken to obtain objective data on coordinated patterns of limb and body movements employed in controlling the flight of a plane. Both direct observation and motion photography were employed for analyzing the details of limb and body movements and for determining differences in patterns of movements characterizing "superior" and "inferior" pilots. While this evaluation of flying habits in relation to plane performance was preliminary in character, it nevertheless represents an example of the application of the techniques of motion study to pilot performance and a source of data relevant to problems of training (88).

Although designed as major investigations in the area of training, the two projects described below yielded no definitive outcomes.

Investigation of Form ACA 342A and of the Ohio State Flight Inventory as Training Aids. This investigation, conducted as part of the Midwest-Navy Project (1942-44), yielded no meaningful results on training due to the practical impossibility of adequately controlling the instructional procedures at the several flight centers where the project was administered (95, 98, 99, 102).*

The Link Trainer as a Synthetic Training Device. While there have been some indications that training on the Link Trainer (Contact) might be substi-

* Other findings of this project, involving the comparison of inspector ratings, are, however, of practical value, and are described in the section on the evaluation of pilot performance.

tuted for a limited number of hours of instruction in the air, experimental investigations in this area at the University of Michigan (1939-41) have so suffered from inadequate design and treatment and from ambiguous data as to render them of little or no practical value (5).

EVALUATION OF PILOT PERFORMANCE

The Committee research program, from its very beginning, included the investigation of criteria of pilot proficiency. Studies have been devoted both to the evaluation of rating and grading methods actually used by instructors and inspectors and to the development of improved measures of pilot performance. The impact of this activity is apparent not only in the Civil Aeronautics Administration operating program but also in the work done on criteria by the military services.

Research on criteria has led to practical outcomes, detailed below, in:

1. *the development and evaluation of new instruments and techniques for the analysis of pilot performance both for research purposes and for field use;*
2. *the evaluation and improvement of commonly used methods for assessing pilot proficiency.*

Development of New Techniques

Standard Flights. One major practical outcome of Committee research on criteria has been the application of the concept of standardized test situations to aviation through research at the University of Pennsylvania (1939-43). Through this project, the Committee research program has provided, for use in the air, standard patterns of maneuvers analogous to the standard series of driving operations used both by civilian agencies and by the military services in measuring proficiency in the operation of a motor vehicle.

Standard flights (Exhibit 4) have been developed for various stages of the Civilian Pilot Training and War Training Service courses. Such standard flights have been used extensively in research conducted by the Committee on Selection and Training of Aircraft Pilots (88, 89, 95, 99). It is difficult to evaluate directly the influence which the concept of standard flights has had upon the operating program of the Civil Aeronautics Administration. However, the following facts may be of interest in this connection:

1. Standard flights have been prepared in descriptive and graphic form for nearly a score of airports at which CAA pilot training programs have been in operation. The use of standard flights was discussed with the personnel of the Civil Aeronautics Administration, General Inspection Division, as early as January, 1941 (82), and with personnel of the CAA Standardization Center at Houston, Texas, in 1942.

2. A manual, in the form of a bulletin, entitled *Standard Check Flight Procedures* (140), prepared in 1942, by the Committee on Selection and Training of Aircraft Pilots, was distributed by the CAA to flight supervisors throughout the country. It was also used in connection with the course in training methods given to personnel in the CAWTS Secondary Instructor Course described on page 506.

So far as is known, the Committee research program was the first to develop and make field use of the standard flight as a fundamental technique in pilot evaluation. There is every reason to believe that the concept and techniques of standard flights as developed in Committee research have filtered into the research and operating activities of the military services in the United States. Particular interest in this development has been expressed by the research personnel of the Royal Air Force which has made considerable use of standard

flights in evaluating pilot performance as one basis for the classification of aircrew personnel. The "standard flight" represents an instrument of great potential value in connection with formulation of plans for the training of civilian pilots in the post-war era.

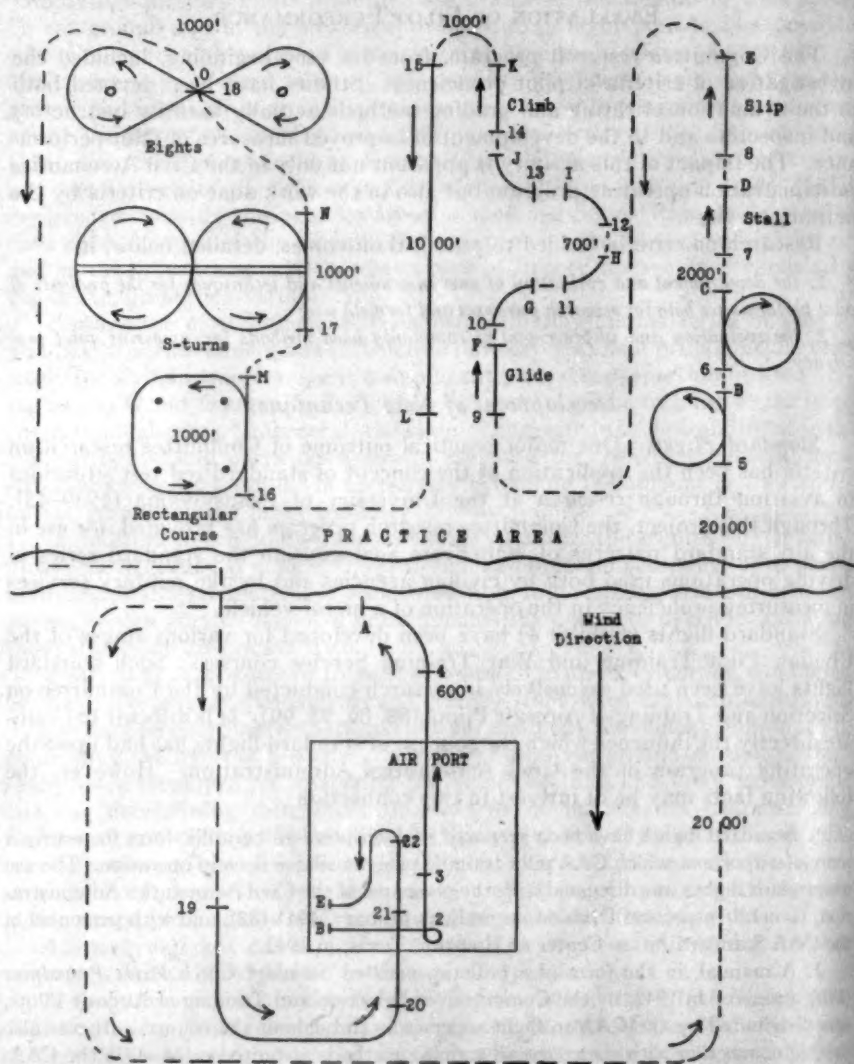


EXHIBIT 4. STANDARD FLIGHT D (For use at Boston Metropolitan Airport, Norwood, Mass. and Muller Field, Revere, Mass.)

Ohio State Flight Inventory. Prior to the initiation of research by the Committee on Selection and Training of Aircraft Pilots, evaluation of pilot performance was limited largely to the assignment of ratings on individual maneuvers and grades on over-all flight performance without detailed or controlled refer-

ence to specific aspects of the performance. Beginning in 1939, research at Ohio State University was directed towards the development of a rating technique, including a standardized procedure for recording observations on specific items of pilot performance and an objective method of scoring such observations.

This research has led to the preparation of the Ohio State Flight Inventory, which is a comprehensive and standardized check list of items descriptive of a pilot's performance during flight. Check sheets are available for each maneuver

STEEP TURNS

	LEFT			RIGHT		
	Entry	Turn	Recovery	Entry	Turn	Recovery
<u>CONTROL USE</u>						
Simultaneous.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Successive.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Slips.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Skids.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Neither.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rudder Pressure:						
Correct.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Incorrect.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<u>PRECISION</u>						
Bank.....	Constant	<input type="checkbox"/>			<input type="checkbox"/>	
	Varies	___°			___°	
Speed.....		___MPH			___MPH	
Speed is:	Constant	<input type="checkbox"/>			<input type="checkbox"/>	
	Varies	___MPH			___MPH	
Altitude is:	Constant	<input type="checkbox"/>			<input type="checkbox"/>	
	Varies	___ft.			___ft.	
Recovers:	On heading	<input type="checkbox"/>			<input type="checkbox"/>	
	Off heading	___°			___°	

EXHIBIT 5. SAMPLE PAGE FROM "OHIO STATE FLIGHT INVENTORY"

taught in the CAA elementary course. Items are grouped, whenever possible, according to the portion of the maneuver being observed, as for example, entry, turn proper, and recovery in turns. When used in conjunction with standard flights, the Inventory provides for standardized observation and recording of the details of pilot performance during each maneuver. In addition, methods have been devised to yield maneuver scores and flight scores.

The Ohio State Flight Inventory has undergone several revisions based upon research and on field use of the instrument (9). For the form currently in use

(Exhibit 5) there has been provided a detailed manual giving specific instructions for its use (97).

Student Pilot's Name _____

A SCALE FOR RATING PILOT COMPETENCY

1. Considering his training, how skillful is he in carrying out precision maneuvers (spot landings, figure eights, etc.)? No opportunity to observe

very skillful _____ high average _____ average _____ low average _____ very poor

2. How does he handle the controls?

awkward over or under controls _____ considerably over or under controls _____ some over or under control _____ handles controls fairly smoothly _____ very smoothly and correctly

3. How carefully does he check his plane and engine before taking off?

very carefully _____ carefully _____ reasonably carefully _____ not carefully enough _____ does not check it

4. As compared with the other students you have trained, how readily does he "catch on" to your instructions?

very fast learner _____ fast _____ average _____ slow _____ very slow

5. To what extent does he have the feel of a ship?

reasonably well _____ well _____ fairly well _____ poorly _____ not at all - flies mechanically

6. Does he show respect for a ship and its motor?

takes excellent care _____ takes good care _____ shows reasonable respect for both _____ tends to be careless _____ no regard at all

7. How tense or relaxed is he when flying?

extremely tense _____ rather tense _____ slightly too tense _____ almost sufficiently relaxed _____ (slightly) relaxed

8. Is he inclined to show off while flying a plane?

almost always _____ frequently _____ sometimes _____ seldom _____ never

9. How easily does he become upset when something goes wrong, for example, a motor failure?

very easily upset _____ easily upset _____ sometimes upset _____ usually calm and controlled _____ always calm and controlled

10. How confident is he of his flying ability?

much too confident _____ slightly over confident _____ sensibly confident _____ not confident enough _____ entirely lacking in confidence

11. Does he like to try out new things, new maneuvers and cross country trips, for example?

always tries new things _____ frequently tries new things _____ sometimes tries new things _____ rarely tries new things _____ never tries new things

12. How good is his judgment with regard to taking flying risks? (weather, stunting, etc.)

extremely cautious takes no unnecessary risks _____ rarely uses poor judgment _____ takes some unnecessary risks _____ takes many unnecessary risks _____ extremely reckless

13. How well is he satisfied with his flying ability?

always tries to improve _____ considerable effort at improvement _____ some effort at improvement _____ fairly well satisfied _____ entirely satisfied

14. In your opinion, considering skill, emotional stability, judgment, etc., how good an "all-around pilot" is he likely to become?

top notch private pilot _____ better than average private pilot _____ average private pilot _____ poorer than average private pilot _____ very poor - will not fly long

Rated by _____ Instructor

EXHIBIT 6. PURDUE RATING SCALE

The Ohio State Flight Inventory has served as a valuable source of criterion data in Committee research, such as in the 1942 Midwest Project (94) and in more recent studies at the Institute of Aviation Psychology, University of

Tennessee (32, 100). It has become familiar to many CAA flight instructors and inspectors both through its use in field research and through the course on training methods given at the institutes held at the University of Minnesota and at Ohio State University, in 1943, referred to on page 506. Copies of the current version have been supplied to the CAA Division of Research for use in research at Stephens College, Columbia, Missouri.

In general, the principle of standardized observation and recording of specific items of flight performance has found wide application in pilot evaluation. Copies of Ohio State Flight Inventory sheets and manual were requested in 1943 by the Army Air Forces for try-out on an experimental basis. CAA Form ACA-342Z, issued by the Civil Aeronautics Administration in 1943, embodies principles for observing and recording flight performance earlier used in the Ohio State Flight Inventory.

Purdue Scale for Rating Pilot Competency. This scale (Exhibit 6) was developed at Purdue University (1940) on the basis of preliminary research during which several other scales were constructed and the best points of each combined into a 14-item scale for experimental study. A factor analysis (40) showed that the items in the scale were, in general, measuring three factors, tentatively identified as "skill," "judgment," and "emotional stability." Experiment also indicated that ratings on this scale differentiated between criterion groups represented by the "best" and the "poorest" students of each of 91 instructors in a large number of flight training centers.

The rating scale has an important advantage in terms of ease of administration. It has been employed as a criterion measure in the Midwest Project (1942) and in connection with other research sponsored by the Committee on Selection and Training of Aircraft Pilots. The scale has been adapted for use in Navy pilot training and by the Northeast Airlines.

Objective Recording of Pilot Performance. An important outcome of Committee research on criteria has been the development of apparatus and techniques for recording in objective and permanent form the actual performance of the pilot and of the plane during flight. Two recording methods, *graphic* and *photographic*, have been investigated.

Research on the *graphic* method involved, first of all, the evaluation at Tulane University (1939-40) and at the University of Pennsylvania (1940-41) of commercial recorders, including the Friez Flight Record Analyzer and the Redhed Ride Recorder. Experimental trial of these instruments at Tulane University (83), at the University of Maryland (2), and at Harvard University (58, 59) early revealed basic limitations in these instruments. A detailed quantitative and qualitative analysis (83, 84) of graphic records, in research conducted at the University of Pennsylvania, has led to important conclusions concerning the possible use of such instruments in field work and in quantitative research. On the basis of these studies the Committee drew up specifications for a recorder particularly suitable for field use. A model of this instrument, known as the CAA-NRC Flight Recorder (61) was constructed at the Massachusetts Institute of Technology (1942-43). Further investigation with this apparatus is necessary in order to provide information as to its practical value and techniques for the analysis of the records. Although loaned to the U. S. Navy for field trial, little has been done with the recorder since its construction in 1943.

Research on *photographic* techniques has resulted in the development of installations useful in recording flight and control movement data descriptive of pilot performance. Problems of photographic recording were attacked inde-

pendently at the University of Rochester (1939-40) and at the University of Pennsylvania (1939-44). While the Rochester project, with the cooperation of the Director of Research, CAA, proceeded immediately to the development of a concealed photographic unit, including an instrument panel and control movement indicator (64), the Pennsylvania group, in its earlier studies, photographed directly the plane instrument panel and the actual manipulation of controls by the pilot (88).



EXHIBIT 7. CAMERA FIELD—PHOTOGRAPHIC INSTALLATION

Present installations, adapted with the aid of the staff of the Institute of Aviation Psychology, University of Tennessee, provide for photography of an instrument panel and of a control movement recorder, developed at the University of Pennsylvania, located in the baggage compartment of the plane (Exhibit 7). Both the photographic installation and methods of analyzing photographic records developed in research at the University of Pennsylvania have been used in obtaining objective criterion data in the 1942 Midwest Project (89), the 1943 Midwest-Navy Project, and in studies currently conducted at the Institute of Aviation Psychology, University of Tennessee. There has been a considerable exchange of information on photographic methods with the Empire Central Flying School, both through the RAF Delegation and through representatives from training activities in Great Britain.

Graphic and photographic records and associated methods of analysis do

not yield direct measures of certain aspects of pilot performance, such as observance of safety precautions, use of certain types of judgment, etc. They yield measures primarily of value in analyzing the *skill* displayed in the execution of maneuvers and are particularly useful in research where detailed and objective information on the level of skill exhibited by the pilot is desired. Because of their objectivity, graphic and photographic records provide basic data for determining the reliability of a single test flight, and in selecting, for pilot assessment, those aspects of flight performance which are relatively stable from flight to flight. It is also possible that graphic and photographic methods could be used for diagnosing specific faults of students who have difficulty in learning to fly, in much the same way as motion photographs are currently employed in the analysis of the faults made by members of football teams during actual play.

Investigations of Commonly Used Techniques for Pilot Evaluation

In addition to developing and evaluating new instruments and techniques, the Committee has conducted research on the evaluation and improvement of procedures commonly used in CAA pilot training programs for the assessment of pilot performance. Following is a discussion of Committee activities in this area.

Analysis of CAA Rating and Grading Methods. In 1939, when the Committee research program was initiated, two methods were used for the evaluation of pilot performance in the CAA Civilian Pilot Training program. One, designed for use by flight instructors, called for log book ratings on a 5-point scale on each maneuver practiced during instruction flights. The other, used by CAA flight inspectors at the time of the final flight test for licensing purposes, called for grades on a per cent basis.

A study at Tulane University (1939), involving an analysis of the records of student pilots trained at 12 CPT centers (35), showed low correlations between instructors' ratings and grades given by flight inspectors, and other serious limitations in the evaluation procedures. Lack of agreement between instructors' ratings and flight inspectors' grades was also reported in a study (43) at Purdue University (1939). Studies at Ohio State University (1939-41) revealed marked disagreements between pairs of instructors and between pairs of inspectors in rating pilots (9, 13). On the whole, research investigations showed that the systems of grading used in the field did not yield adequate criterion data for research purposes or for the accurate field assessment of pilot performance.

Almost every study on the prediction of student pilot success has made use of the "pass-fail" criterion. Although of value in the early stages of Committee research, the "pass-fail" criterion became less and less useful as the incidence of failure was reduced. There has therefore been increasing dependence, in research, upon the more sensitive and more objective methods for assessing pilot proficiency developed in Committee investigations described above.

In general, Committee research has been of extreme importance in pointing to the need for revising and improving methods for evaluating pilot proficiency traditionally employed in civilian pilot training programs. In this connection, there has been direct cooperation with the Division of Safety Regulation, CAA, in analyzing the forms and techniques employed by flight inspectors in arriving at flight grades as a basis for the certification of the private pilot. Such studies (1943-44) have involved the evaluation of Form ACA 342Z (13),

a CAA inventory of pilot performance, including the preparation of a detailed manual for the field use of this form (86). Results of investigations which are currently undergoing analysis will yield information on such basic questions as: (a) extent of agreement between inspectors in grading the same student on successive flight tests; (b) extent and nature of inspector differences in emphasizing specific student errors; (c) the reliability of the grade given by the inspector on the basis of a single flight test; (d) the accuracy of inspectors' observations of flight performance during flight tests as recorded in writing on Form ACA 342Z, and verbally, by means of the Air-borne Model Magnetic Wire Recorder (31). It is anticipated that the analysis of inspectors' observations and grades, in comparison with photographic recordings made in the Midwest-Navy study, will point the way towards practical methods of improving techniques employed by inspectors in the assessment of pilot proficiency as a basis for pilot certification.

Additional work on the improvement of instructors' ratings and inspectors' grades has been carried on at the Institute of Aviation Psychology, University of Tennessee, with particular emphasis on methods of grading useful in revealing stages of progress in learning to fly. If current field try-out of this technique yields results comparable to those obtained in preliminary studies, the findings can be of considerable value in improving the practices of instructors and inspectors in the evaluation of flight performance. This is an area which calls for close integration of the Committee research program with the operational activities of the Civil Aeronautics Administration.

Relation of Maneuver Ratings to Total Flight Performance. One of the by-products of the RAF study referred to on page 498 was the development of a criterion measure based on the ratio of successful to unsuccessful flights during flight training, which may well deserve serious consideration in the development of practical field criteria for CAA use (3). Also of possible value in planning for the improvement of flight assessment are data on the relationship between ratings on specific maneuvers and success or failure in flight training gathered in the same investigation (87).

Analysis of Training Time as a Criterion. A practical question for both civilian and military training is the extent to which student performance in the early stages of training is associated with or predictive of final performance. There is evidence from research (1941-42) conducted at the University of Rochester (103), the University of North Carolina (126, 128), and the Midwest Project (1942) that there is no close or consistent relationship between the number of hours spent in early stages of flight training and later success or failure in the course (70, 89). These findings, if confirmed in other studies, can be of particular importance in the training of civilian pilots where it may be unnecessary or even inadvisable to place marked emphasis on time to solo in evaluating pilot performance as a preliminary to wash out. Consideration of such findings might well lead to a revision of the civilian pilot training curriculum involving the removal of time limits for various stages of the training course.

In the investigation of criteria, as in other areas, there are studies which have failed to yield practical outcomes or promising results for reasons enumerated in the Introduction to this report. So, for example, early studies at Pensacola (1940-41), designed to devise a flight score based on the number of possible check flights and re-checks (57), failed to produce results useful to Committee research or to the CAA operating program. Preliminary experiments with a pilot-response recorder (37), developed at Indiana University in 1940, have not led to further use of this instrument either in the research program of the Committee

or in connection with the pilot training and assessment program of the CAA and military services.

Many critical problems with respect to criteria are not yet fully solved, such as (a) the establishment of cut-off points (for example, for washing out student pilots) on the Purdue Scale for Rating Pilot Competency or the Ohio State Flight Inventory, (b) the *grading* of graphic or photographic records on a scale of excellence of performance, (c) the determination of the relative value of various criterion measures and a means of combining them into an optimum criterion battery, and (d) the measurement of the "judgment" and "emotional stability" aspects of over-all pilot performance. Nevertheless, the over-all picture, as in the case of research on selection and training, is one of significant and practical achievement.

EMOTIONAL DISTURBANCES ASSOCIATED WITH LEARNING TO FLY

Several studies, conducted chiefly in the earlier years of research, have been concerned with emotional and physiological reactions associated with flight. While several of these studies yielded results of theoretical interest, this group as a whole has perhaps produced the smallest returns in the way of practical findings directly applicable to flight. However, such studies were of value in indicating the areas of research upon which emphasis could be most profitably placed in the over-all program of the Committee on Selection and Training of Aircraft Pilots.

Sleep Motility. A study at the University of Virginia (1939-40), concerned with sleep motility of student pilots undergoing flight training (29), directed attention to motility during sleep following flight lessons. Correlations with success in flight training were not obtained and the study had no direct useful outcomes.

Salivary Secretions and Respiratory Changes. Laboratory tests on salivary secretion of students receiving flight training were made at Cornell University (1940), where investigators also obtained records of respiration and pulse rate during actual flight lessons (68). Limitations in experimental design and in the presentation and discussion of results make this study of questionable practical value.

Muscle Potentials. At the New York Psychiatric Institute (1940-41) a Myo-Voltmeter was designed to measure the electrical output of muscles during flight. Records from this instrument are visually apparent to both instructor and student during flight and the proposal was made that the instructor call the attention of the student to the level of tension associated with the performance of particular maneuvers. The apparatus also served to provide a cardio-tachometer record.

The use of the instrument is limited to the extent that absolute measurements cannot be obtained for comparing individuals. Exploratory studies were reported (47, 48), but no evidence is available on the trial of the instrument in connection with flight training, although provisions were included for its use in the University of Maryland study of "tension."

Tension. No final report providing statistical data and conclusions has been submitted on extended studies of "tension" during flight training conducted at the University of Maryland (1939-43).^{*} In preliminary and informal reports (53), attention has been called to the difficulties and ambiguity in applying the term "tension" to the flight situation. Instruments for measuring

^{*} A final report has since been received.

and recording muscle tension and associated physiological functions are available from these studies.

Skin Temperature and Perspiration. At Yale University (1940) an improved instrument was developed for measuring skin temperature and sweating in airplane pilots (62). This instrument, small enough to be attached to the palm of the pilot's hand, is known as the CAA-NRC Micro-Recorder. Preliminary tests showed appreciable changes in temperature and in humidity associated with flight experience. Efforts to obtain adequate ratings by instructors on tension and emotional stress during flight were unsuccessful. Twenty-five units of the instrument are available for further studies of response during flight.

Muscular Set. At New York University (1939-43) an elaborate polygraph was constructed for experimental work in the measurement of "muscular set." Findings are available on subjects examined in a laboratory situation (27), but no use has been made of the instrument in studies of pilot reaction and performance. The instrument was recently loaned to the National Defense Research Committee for special investigations being conducted by one division of this war research agency.

Noise and Vibration. Studies at the State University of Iowa (1940-43) indicated that noise and vibration conditions, similar to those encountered in military aircraft during flight, showed no significant effect upon performance on the Mashburn Serial Action Test, even when continued for four and one-half hours (50). No measures were obtained of increased physiological cost. The study led to no specific proposals for action.

STUDIES OF AIRSICKNESS

Considerable work in the study of airsickness has been carried on at Wesleyan University (1939-43) and at the University of California (1940-43). These were largely exploratory studies designed to test hypotheses concerning psychological and physiological determinants of airsickness (6, 122, 123).

One practical outcome of this work is a popular pamphlet, entitled *How to Prevent Airsickness*, which has been widely distributed by the Civil Aeronautics Administration (81). Studies of airsickness have also yielded a number of research tools, particularly a motion sickness questionnaire which has been adapted for use in an extension of studies of motion sickness under the auspices of the Committee on Aviation Medicine, Committee of Medical Research, Office of Scientific Research and Development. In addition, the studies have contributed to the effectiveness of the work of other organizations, such as the Canadian Associate Committee on Seasickness, particularly in avoiding wasted effort in the exploitation of unprofitable leads in research.

More recently (1943-44), use has been made of the Stability of Orientation Test, developed at Brooklyn College (132), in the further examination of determinants of visually-induced airsickness as a supplementary feature of research being conducted at that institution.

AVIATION ACCIDENTS

In a current study (1943-44) the causes of civil aviation accidents, and the maneuvers most closely related to these accidents (Exhibit 8), are being investigated. The frequency with which fatal accidents are associated with stalls, particularly those growing out of turns at low altitudes, has suggested the necessity of important basic changes in the training program. A practical outcome of such research findings and conclusions would be a shift in emphasis during training from precision entries and execution of stalls and spins to

training in the avoidance of and immediate recovery from the stall condition, possibly through extended practice in slow flying.

GENERAL OUTCOMES

In addition to the specific outcomes summarized on the preceding pages, there have been important by-products from the operation of the Committee on Selection and Training of Aircraft Pilots.

Committee meetings have served as a forum for the exchange of ideas among civilian and military agencies and personnel concerned with the problems of aviation psychology. This was particularly true in the early years, since the Committee on Selection and Training of Aircraft Pilots was functioning actively before the military services had established units for psychological

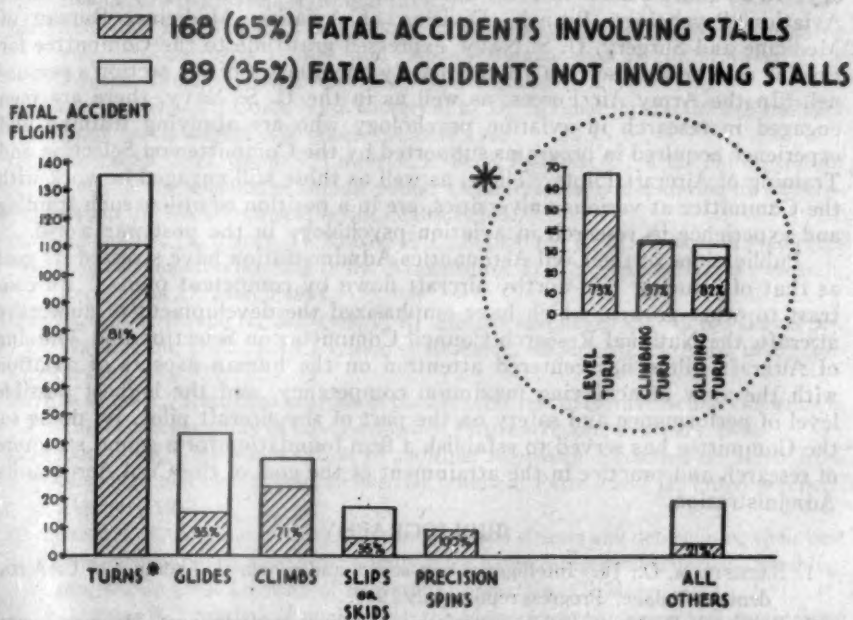


EXHIBIT 8. LEAD MANEUVERS IN 257 FATAL ACCIDENTS WITH NO STRUCTURAL DEFECT

research in aviation. The Committee continues to serve as a medium for the exchange of experience, for formulating objectives, and for facilitating the application of such research. Committee membership and liaison include representatives from the military services of the United States and foreign countries, as well as from the civilian agencies concerned with problems of aviation personnel. This fact has contributed considerably to the effectiveness of the Committee in these respects.

Numerous universities and research centers throughout the country have been drawn into research in aviation psychology through participation in the work of the Committee on Selection and Training of Aircraft Pilots, including the universities and laboratories which have conducted basic research under grants from the Committee on Selection and Training of Aircraft Pilots, and approximately 550 additional centers involved in the administration of aviation selection tests through the Standard Testing Program and the CAA-National

Testing Service. Such activities have served to arouse interest in aviation psychology research and to establish a core around which an extensive and effective program of post-war research in aviation psychology can be developed.

In cooperation with the Civil Aeronautics Administration and the Tennessee Bureau of Aeronautics, the Committee on Selection and Training of Aircraft Pilots has established an Institute of Aviation Psychology at the University of Tennessee. The Committee program has led to the organization of a similar center at Ohio State University. In this way, the Committee on Selection and Training of Aircraft Pilots is striving to avoid the cessation of research in aviation psychology which occurred at the end of World War I.

Through the work of the Committee a considerable number of professional men and women have become actively engaged in research in aviation psychology. In an address made in 1943, Commander (then Lt. Cdr.) John G. Jenkins, Aviation Psychology Branch, Division of Aviation Medicine, Bureau of Medicine and Surgery, U. S. Navy, expressed gratitude to the Committee for turning over to that section approximately one-quarter of the section's personnel. In the Army Air Forces, as well as in the U. S. Navy, there are men engaged in research in aviation psychology who are applying training and experience acquired in programs supported by the Committee on Selection and Training of Aircraft Pilots. These, as well as those still engaged in work with the Committee at various universities, are in a position to utilize such training and experience in research in aviation psychology in the post-war world.

Publications of the Civil Aeronautics Administration have stressed its goal as that of insuring "air-worthy aircraft flown by competent pilots." In contrast to other groups, which have emphasized the development of airworthy aircraft, the National Research Council Committee on Selection and Training of Aircraft Pilots has centered attention on the human aspects of aviation with the view of achieving maximum competency, and the highest possible level of performance and safety on the part of the aircraft pilot. By doing so, the Committee has served to establish a firm foundation for a sound structure of research and practice in the attainment of the goal of the Civil Aeronautics Administration.

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 72. SPENCE, K. W., BUXTON, C. E., & MELTON, A. W. The effect of massing and distribution of practice on Rotary Pursuit Test scores. Washington, D. C.: CAA Division of Research, Report No. 44, March 1945. (Restricted.)
 73. SPENCE, K. W., BUXTON, C. E., & MELTON, A. W. The effect of massing and distribution of practice on Two-Hand Coordination Test scores. Washington, D. C.: CAA Division of Research, Report No. 45, April 1945. (Restricted.)

74. STRONG, E. K., JR. Report on interests of aviators. Progress report, July 1941.
75. TAYLOR, C. Postural investigation. Progress report, August 1941.
76. TAYLOR, C. Report on physical fitness testing under National Research Council funds. Progress Report, August 1941.
77. TAYLOR, C. Studies in physical fitness. Unpublished final report, 1941.
78. THORNTON, G. R. Studies of level of confidence during course of flight training. Progress report, 1941.
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81. VAN DE WATER, M., & WENDT, G. R. How to prevent air sickness. Washington, D. C.: CAA Division of Research, October 1942.
82. VITELES, M. S. Proposed standard flights for use in certifying private pilots. November 1941.
83. VITELES, M. S., & BACKSTROM, O., JR. An analysis of graphic records of pilot performance obtained by means of the R-S Ride Recorder. Part I. Washington, D. C.: CAA Division of Research, Report No. 23, November 1943.
84. VITELES, M. S., & BACKSTROM, O., JR. An analysis of graphic records of pilot performance obtained by means of the R-S Ride Recorder, Part II. (A final report in preparation for publication in the CAA Technical Series.)
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87. VITELES, M. S., FRANZEN, R., & ROGERS, R. C. The association between ratings on specific maneuvers and success or failure in flight training of RAF cadets. Washington, D. C.: CAA Division of Research, Report No. 37, October 1944. (Restricted.)
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92. WALKER, R. Y. Analysis of the Link predictor test. Progress report, May 1943.
93. WALKER, R. Y. Correlations of predictors with authoritative criteria, Midwest Project, 1942. Progress report, May 1943.
94. WALKER, R. Y. Data relating to the use of authoritative composite criteria, Midwest data. Progress report, May 1943.
95. WALKER, R. Y. Proposed experiment for testing relative value of teaching aids in flight instruction. May 1943.
96. WALKER, R. Y. Validity coefficients of five selected batteries of predictor tests vs. composite criteria of flight proficiency. Progress report, July 1943.

97. WALKER, R. Y. Manual for administration of the Ohio State Flight Inventory. August 1943.
98. WALKER, R. Y. Changes in the experimental design of the Midwest Project. October 1943.
99. WALKER, R. Y. Materials for use in the Midwest-Navy Training Experiment. October 1943.
100. WALKER, R. Y. Effect of practice in slow flying on performance on stalls and landings. Proposal, March 1945.
101. WALKER, R. Y., & BENNETT, S. Validity of the Strong Vocational Interest Test vs. composite criteria. Progress report, July 1943.
102. WALKER, R. Y., & ROGERS, R. C. Proposed research on the relative effectiveness of teaching aids. July 1943.
103. WANTMAN, M. J. Preliminary report on the Standard Testing Program. Progress report, January 1942.
104. WANTMAN, M. J. Intercorrelations of paper and pencil tests, interview ratings, and criteria (Boston Project). Progress report, Spring 1942.
105. WANTMAN, M. J. Boston Project, Fall cases 1941, test re-test correlations. Progress report, November 1942. (Restricted.)
106. WANTMAN, M. J. Report on the reliability of the Inventory of Personal Data for Prospective Pilots. Progress report, December 1942. (Restricted.)
107. WANTMAN, M. J. Second report on the reliability of the test of Aviation Information. Progress report, December 1942. (Restricted.)
108. WANTMAN, M. J. A comparison of test validities for three samples in the Standard Testing Program. Progress report, January 1943.
109. WANTMAN, M. J. Correlation of the tests in the Standard Testing Program with pass-fail in ground school. Progress report, January 1943.
110. WANTMAN, M. J. Preliminary report on the validity of the Test of Aviation Information. Progress report, January, 1943.
111. WANTMAN, M. J. A report on the validities of the tests in the Standard Testing Program from cases trained under an operator having at least one failure in his group. Progress report, March 1943.
112. WANTMAN, M. J. A report on the criterion correlations and intercorrelations of the BI, MAT, and MC tests, of the Standard Testing Program according to geographic sections of the country. Progress report, March 1943. (Restricted.)
113. WANTMAN, M. J. Second report on the item analysis of the Test of Aviation Information using pass-fail as a criterion. Progress report, March 1943.
114. WANTMAN, M. J. An application of the multiple chi technique and the multiple correlation technique to cases in the Standard Testing Program. Progress report, April 1943.
115. WANTMAN, M. J. Correlations of Boston data, Sept. 1941 to Jan. 1942. Progress report, April 1943.
116. WANTMAN, M. J. Preliminary report on the analysis of the Wendt interview study. Progress report, May 1943.
117. WANTMAN, M. J. Preliminary report on the study of validity of "Ability-to-Take-It" tests. Progress report, May 1943.
118. WANTMAN, M. J. Second report on the comparison of the Franzen cut-off technique and the multiple correlation technique. Progress report, May 1943.
119. WANTMAN, M. J. Second report on the validity of the "Ability-to-Take-It" tests. Progress report, July 1943.
120. WANTMAN, M. J. Third report on the comparison of the Franzen cut-off technique and the multiple correlation technique. Progress report, July 1943.
121. WENDT, G. R. Report on Wesleyan interview project. Progress report, March 1942.

122. WENDT, G. R. Motion sickness in aviation. NRC Division of Anthropology and Psychology, Committee on Selection and Training of Aircraft Pilots, May 1944.
123. WENDT, G. R. Studies in motion sickness. Series A. Washington, D. C.: CAA Division of Research, Report No. 40, December 1944. (Restricted.)
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125. WHERRY, R. J. Analysis of the Carolina Persistence Test. Progress report, August 1942.
126. WHERRY, R. J. Further research on the Pensacola data. Progress report, 1942.
127. WHERRY, R. J. Review of the Carolina Tension Test. Progress report, August 1942.
128. WHERRY, R. J. Weights for biographical items in predicting an extra time allotment at Pensacola. Progress report, 1942.
129. WITKIN, H. A. Visual and postural factors in the determination of the perceived vertical and horizontal. Progress report, 1943.
130. WITKIN, H. A. Summary of a report on an investigation of problems of space orientation as related to the selection and training of pilots. Progress report, January 1944.
131. WITKIN, H. A. Memorandum on the reliability of the Space Orientation Test. Progress report, May 1944.
132. WITKIN, H. A. Design of the experiment of studying the effect of training upon performance in the Stability of Orientation Test. Progress report, February 1945.
133. *The CAA-National Testing Service (Summary of test results and comparisons with success in flight training)*. NRC Committee on Selection and Training of Aircraft Pilots. Washington, D. C.: CAA Division of Research, Report No. 29, November 1944. (Restricted.)
134. *An historical introduction to aviation psychology*. NRC Committee on Selection and Training of Aircraft Pilots. Washington, D. C.: CAA Division of Research, Report No. 4, October 1942.
135. *Investigations of the relative amount of time spent on the ground and in the air by Civilian Pilot Training students*. NRC Committee on Selection and Training of Aircraft Pilots. Washington, D. C.: CAA Division of Research, Report No. 43, March 1945.
136. *The psychology of learning in relation to flight instruction*. NRC Committee on Selection and Training of Aircraft Pilots. Washington, D. C.: CAA Division of Research, Report No. 16, June 1943.
137. *Report on CAA-National Testing Service (First Phase: June 20, 1942-Aug. 2, 1942)*. NRC Committee on Selection and Training of Aircraft Pilots. Washington, D. C.: CAA Division of Research, Report No. 9, January 1943. (Restricted.)
138. *Report on CAA-National Testing Service (Phase II: Aug. 3-Sept. 15, 1942; Phase III: Sept. 16-Nov. 15, 1942; Phase IV: Nov. 16, 1942-Jan. 21, 1943)*. NRC Committee on Selection and Training of Aircraft Pilots. Washington, D. C.: CAA Division of Research, Report No. 19, August 1943. (Restricted.)
139. *Report on CAA-National Testing Service (Previous flight training and flight training preferences as related to pilot screening test scores)*. NRC Committee on Selection and Training of Aircraft Pilots. Washington, D. C.: CAA Division of Research, Report No. 30, May 1944.
140. *Standard check flight procedures*. NRC Committee on Selection and Training of Aircraft Pilots. Washington, D. C.: CAA Division of Research, Bulletin No. 1, 1942.

PROCEEDINGS OF THE SIXTEENTH ANNUAL MEETING OF THE EASTERN PSYCHOLOGICAL ASSOCIATION

THEODORA M. ABEL

Secretary

The sixteenth annual meeting of the Eastern Psychological Association was held in the Main Building, College of the City of New York, New York City, April 6 and 7, 1945. Dr. John G. Peatman, assistant dean at the College, acted as local chairman on arrangements. In order to comply with the directive from the Office of Defense Transportation regarding long distance traveling for members of an association of over fifty people, the Board of Directors voted to limit attendance at the meeting to members and guests of the local New York area with the exception of officers of the Association, and participants in the program. In spite of the restriction, attendance at the meeting was 489; 206 members, 257 guests, and 26 applicants for membership.

The program consisted of thirty-nine fifteen-minute papers distributed in seven topical sessions, two films, a general session with two invited speakers, and the presidential address and three round tables. Approximately one-half of the papers was devoted to a topic related to some phase of social adjustment and maladjustment of the human organism, while the other half was concerned with the more biological aspects of human and animal behavior. Problems bearing on the war and peace efforts were few. There were three papers on military psychology, one on a discussion of the German enigma, while one large and well-attended round table discussed the need for qualified personnel in veteran rehabilitation centers. There were four exhibits on display in show cases near the registration desk. The Psychological Corporation showed new test materials, and the Castle School in New York demonstrated educational material to be used in the teaching of arithmetic. There was an exhibit of the drawings of children from the educational clinic of City College, and one of the handwork done by unstable girls in the occupational therapy department of Letchworth Village.

The presidential address was delivered in the Great Hall of City College on Friday afternoon. Edna Heidebreder of Wellesley College, introduced Henry E. Garrett of Columbia University, president of the Association, who spoke on *Problems in the Study of Leadership*. Professor Garrett summarized the picture of successful and unsuccessful combat officers as selected by company commanders of fourteen different divisions. The successful officers had more education and higher leadership ability in school than the unsuccessful officers. The successful officers did not necessarily have better school grades than the poor officers but they were likely to get higher GCT (General Classification Test) scores—physical ability, first, knowledge of the job, second, and control over men, third, were the traits that best distinguished the two groups.

Elections and appointments: Officers were elected to serve as follows: *President*, 1945-46, Edwin G. Boring, Harvard University; *Directors*, 1945-48, Henry E. Garrett, Columbia University, Joseph McV. Hunt, Brown University. The Board of Directors appointed as members of the program committee, 1945-48, Francis W. Irwin, University of Pennsylvania; 1945-47, Wallace H. Wulfeck, to fill the unexpired term of J. McV. Hunt, Brown University; as representative on the Council of the American Association for

the Advancement of Science, 1945-47, Herbert W. Rogers, Lafayette College; and as the Auditing Committee, Charles W. Manzer and Leland W. Crafts, New York University.

The following actions were taken at the annual business meeting.

1. Proceedings of the 1944 Meeting as printed in the *Psychological Bulletin* were accepted.

2. The reports of the Secretary and the Treasurer were accepted, and a budget totaling \$735.00 was adopted for the year 1945-46.

3. Eighty-two applicants for membership were taken into the Association on recommendation of the Board of Directors.

4. On recommendation of the Board of Directors it was voted to discontinue the Clearing House of Information relative to job placement at the end of the fiscal year, since the Clearing House had been set up only as a temporary agency until the Office of Psychological Personnel became more firmly established.

5. The following resolution was unanimously adopted: That the members of the Eastern Psychological Association present at this meeting go on record as disapproving any quota system for any group in the field of psychology.

7. The next resolution is prefixed by an excerpt from "The Field of Clinical Psychology," *J. Clinical Psychol.*, 1945, 1, 1, 13. This excerpt reads: "A further practical problem of importance in the selection of students involves the avoidance of undue representation of any one racial group among those accepted for training. Perhaps because of long racial experience with suffering and personality problems, certain groups of students show an unusual interest and propensity for psychological science which has both favorable and disadvantageous aspects. While disclaiming racial intolerance, it nevertheless seems unwise to allow any one group to dominate or take over any clinical specialty, as has occurred in several instances. The importance of clinical psychology is so great for the total population that the profession should not be exploited in the interests of any one group in such a manner that the public acceptance of the whole program is jeopardized."

The resolution which was passed unanimously reads as follows: "That it is the sense of this meeting that the first editorial in the first number of the *Journal of Clinical Psychology* be disapproved and that the members of the Association present at this meeting instruct its committee (special committee appointed by the Board of Directors) to poll the membership on a resolution expressing its sentiments toward the editorial. It is further resolved, that the committee act as soon as possible and give full publicity to the results of the poll.* It is further resolved that the committee send the results of the poll to the Committee on Professional Ethics of the American Psychological Association with the suggestion that this committee take action also."

8. A resolution thanking President Wright and the administrative officers of the College of the City of New York, the Department of Psychology, and the Local Committee on Arrangements, for their kind hospitality and excellent arrangements made for the meeting of the Association was unanimously adopted.

The financial statement for the fiscal year 1944-45, prepared by the Treasurer and verified by the Auditing Committee is as follows:

* The results of this poll are reported in an appendix to these Proceedings (see p. 532).

FINANCIAL STATEMENT AS OF MAY 1, 1945
FOR THE FISCAL YEAR 1944-1945

Income

Membership Dues

Dues for the current year (1944-45).....	\$ 488.00
Arrears for 1943-44.....	83.00
Arrears for 1942-43.....	13.00
Advance payments.....	6.00
Applicant's fees.....	57.00
Guest fees.....	253.00
Interest on Savings Account.....	21.09
Total Income.....	\$ 921.09

Expenditures

Publication of <i>Proceedings</i> (1943-44).....	\$ 7.03
Office of the Secretary.....	207.80
Office of the Treasurer.....	83.58
Travelling expenses of officers.....	3.90
Printing, mimeographing and stationery.....	120.00
Postage.....	78.10
Miscellaneous supplies and expense.....	25.66
Program Committee.....	31.19
Room for Directors meeting.....	10.00
Bank charges.....	.70
Total Expenses.....	567.96
Surplus for 1944-45.....	\$ 353.13

Balance Sheet

Cash: Fifth Avenue Bank of N. Y.....	\$1181.88
New York Savings Bank.....	1312.84
Petty cash (Secretary).....	20.00
Petty cash (Treasurer).....	20.00
Total Cash.....	\$2534.72
Capital: As of May 1, 1944.....	2181.59
Surplus for 1944-45.....	353.13
Total Capital.....	\$2534.72

The program of the meeting was as follows:

EASTERN PSYCHOLOGICAL ASSOCIATION ABNORMAL AND CHILD PSYCHOLOGY

Chairman: JAMES O'GORMAN, Hunter College

- Social Contacts of Psychiatric Patients: A Preliminary Study.* ALBERT I. RABIN, New Hampshire State Hospital.
- Attitudes of Mental Patients towards Prolonged Hospitalization.* EUGENIA HANF-MANN, Mount Holyoke College.
- A Comparative Study of Institutionally Adjusted and Maladjusted Defective Delinquents.* SAMUEL B. KUTASH, Harlem Valley State Hospital.
- Observations in a Group of Six- and Seven-Year-Old Children in Recreational Activities.* ALICE FRIEDMANN, Manhattanville Child Care Center.
- Adult Adjustment of Foster Children of Alcoholic and Psychotic Parentage and the Influence of the Foster Home.* ANNE ROE, Yale University.
- An Experimental Study of Ego-orientation in Work.* HELEN BLOCK LEWIS, New York City.

CLINICAL AND MILITARY PSYCHOLOGY

Chairman: CARNEY LANDIS, New York Psychiatric Institute and Hospital, and Columbia University

- An Experimental Investigation of Materials for Teaching Reading to the Mentally Retarded Adult.* MAX COOPER, Institution for Male Defective Delinquents, Napanoch, N. Y. (Sponsored by Brian E. Tomlinson.)
- Maladjustment in Old Age.* GEORGE LAWTON, New York City.
- Clinical Use of the Mental Deterioration Index of the Bellevue-Wechsler Scale.* JOSEPH LEVI, SADI OPPENHEIM, DAVID WECHSLER, New York University and Bellevue Psychiatric Hospital.
- A General Questionnaire.* LIEUT. J. M. SACKS AND CPL. S. B. ZUCKERMAN, Army of the United States.
- The Cornell Service Index: A Method for Quickly Assaying Personality and Psychosomatic Disturbances in the Men in the Armed Forces.* ARTHUR WEIDER, KEEVE BRODMAN, BELA MITTELMANN AND HAROLD G. WOLFF, Cornell Medical College; David Wechsler, New York University and Bellevue Psychiatric Hospital.
- The Use of the Cornell Service Index—Form S—in the Evaluation of Psychiatric Problems in a Naval Hospital.* LIEUT. NATHANIEL WARNER (MC) USNR, AND LIEUT. (J.G.) MARGARET WILSON GALICO H(W), USNR. (Sponsored by Arthur Weider.)
- A Psychological Study of Sexual Promiscuity and Venereal Disease.* ROBERT WEITZ AND H. L. RACHLIN, Midwestern Medical Center, United States Public Health Service. (Sponsored by Brian E. Tomlinson.)

COMPARATIVE AND PHYSIOLOGICAL

Chairman: FRANK A. BEACH, American Museum of Natural History

- The Influence of the Male Cichlid Fish, *Tilapia Macrocephala* on the Spawning Frequency of the Female.* LESTER R. ARONSON, American Museum of Natural History. (Sponsored by Frank A. Beach.)
- The Effect of Electroshock Convulsions on the Maze Habit in the White Rat.* CARL P. DUNCAN, Brown University. (Sponsored by Harold Schlosberg.)
- The Effects of Electroshock Convulsions on Double Alternation Lever-Pressing in the White Rat.* ELLIOT R. MCGINNIES, JR., Harvard University. (Sponsored by Harold Schlosberg.)

- Some Conditions of Hoarding in White Rats.* J. McV. HUNT, Brown University.
Postural Behavior of Infant Chimpanzees as Studied by the Gesell Developmental Schedule. CAPT. AUSTIN H. RIESEN, Army of the United States, and ELAINE F. KINDER, Yerkes Laboratories of Primate Biology.
Speech Intelligibility Under Various Degrees of Anoxia. G. M. SMITH, College of the City of New York, and LIBUT. (J.G.) C. P. SEITZ, USNR.

LEARNING AND CONDITIONING

Chairman: HAROLD SCHLOSBERG, Brown University

- On the Roles of Activity and Participation in Learning and Reminiscences.* THELMA G. ALPER AND ERNEST A. HAGGARD, Harvard University.
Some Factors Involved in Conditioning the Autokinetic Effect. E. A. HAGGARD AND R. BABIN, Harvard University.
Stimulus Equivalence in Chained Conditioning. J. DONALD HARRIS, Medical Research Laboratory, Submarine Base, New London.
The Spread of the Influence of Rewards to Connections Remote in Sequence and Time: Comparison of Young and Old Adults. IRVING LORGE, Columbia University.
Meaningful Similarity and Interference in Learning. CHARLES E. OSGOOD, Yale University.
Genetic Changes in Semantic Conditioning. BERNARD F. RIESS, Hunter College.
Conditioning and Extinction of Subordination in the Rat. JOHN P. SEWARD, Connecticut College.

GENERAL SESSION

Chairman: EDNA HEIDBREDER, Wellesley College

- Is the Psychopathological Interpretation of the German Enigma Necessary?* THEODORE ABEL, Columbia University.
The Response of Organisms to Stimulus Configurations and the Hypothesis of Afferent Neural Interaction. CLARK L. HULL, Yale University.

PRESIDENTIAL ADDRESS

- Problems in the Study of Leadership.* HENRY E. GARRETT, Columbia University.

APPLIED AND GENERAL PSYCHOLOGY

Chairman: ALBERT D. FREIBERG, Psychological Corporation

- Color Aptitude Test.* FORREST LEE DIMMICK, Hobart College.
Tonal Range Preferences of Broadcast Listeners. PHILIP EISENBERG AND HOWARD A. CHINN, New York City.
Some Factors Affecting the Comparison of Short Temporal Intervals. B. R. PHILIP, Fordham University.
On the Method of Psychology. MORITZ LÖWI,* Connecticut College.

PERSONALITY

Chairman: GARDNER MURPHY, College of the City of New York

- Psychoanalysis and a Dynamic Use of the Questionnaire Method.* ELIZABETH F. HELLERSBERG, Good Habits Committee of the National Research Council.

* Paper was read by Mrs. Löwi, due to the death of Dr. Löwi.

- The Formula of Configuration in Graphic Expression: An Experiment in Personality and Aesthetics.* WERNER WOLFF, Bard College.
- Advances in the Technique of the Thematic Apperception Test.* FREDERICK WYATT, McLean Hospital and Massachusetts General Hospital.
- The Discovery of Functional Unities in Personality Traits.* RAYMOND B. CATTELL, Duke University.

SOCIAL PSYCHOLOGY

Chairman: SOLOMON ASCH, New School for Social Research

- Public Opinion Toward Conscientious Objectors: Progress Report.* LEO P. CRESPI, Princeton University.
- A Case Study in the Perpetuation of Error.* GEORGE W. HARTMANN, Columbia University.
- Cultural Conflict and the Feminine Role: An Experimental Study.* GEORGENE H. SEWARD, Connecticut College.
- A Study of Personality and Attitude Measurements of Students who Belong to the Inter-Collegiate Gospel Fellowship.* LUTHER CRAIG LONG, Psychologist for the War Department, Grand Central Palace Induction Station. (Sponsored by Brian E. Tomlinson.)
- A Preliminary Study of the Factors in the Identification of One's Own Handwriting.* M. E. TRESSLETT, Hunter College.

FILMS

Chairman: BERNARD F. RIESS, Hunter College

- Condition, Extinction and Disuse in the Fighting Behavior of the Rat.* JOHN P. SEWARD, Connecticut College.
- The Expression of Personality* (with verbal comments). WERNER WOLFF, Bard College.

ROUND TABLES

- New Developments in Public Opinion Research.* PAUL F. LAZARSFELD, *Chairman.* *Participants:* BERNARD BERELSON, HERTA HERZOG, BEN GEDALECIA.
- The Role of Rorschach Method in Planning for Treatment and Education.* BRUNO KLOPPER, *Chairman.* *Participants:* FRITZ SCHMIDL, WILLIAM GOLDFARB, MORRIS KRUGMAN, MARGUERITE HERTZ.
- Veterans Rehabilitation: The Need for Qualified Personnel.* JOHN G. PEATMAN, *Chairman.* *Participants:* CARL ROGERS, MEYER H. SARKIN, ROBERT H. MATHEWSON. *Discussants:* ROBERT A. BROTEMARKELE, DONALD G. MARQUIS, BRUCE V. MOORE, PERCIVAL M. SYMONDS.

APPENDIX TO PROCEEDINGS

EASTERN PSYCHOLOGICAL ASSOCIATION

RESULTS OF POLL ON RESOLUTION RE EDITORIAL IN JOURNAL OF CLINICAL PSYCHOLOGY

The Special Committee* appointed to draft a resolution disapproving an editorial paragraph in the *Journal of Clinical Psychology* (Vol. I, No. 1) which

* See p. 528.

implied support for a quota system in the field of clinical psychology, submitted the resolution in a mail referendum to the 800 members of the Association, together with opportunities to vote on the desirability of offering the resolution to certain professional journals and to the public press for publication and whether or not the members favored a standing committee to examine public statements by psychologists bearing on the issue of racial and religious prejudice.

A statement of the questions asked and the results obtained follows:

1. I vote in favor of the following resolution.

The Eastern Psychological Association is convinced that in all branches of psychological work the highest standards of intellectual and personal fitness should prevail. The requirement is probably more exacting in the field of psychology than in most other departments of science, since research with, and direct service to, human beings demand intellectual competence, personal integrity, and a sensitive and well-balanced personality. Particularly to the field of clinical psychology do these requirements apply.

In the process of selecting, training, and placing young psychologists in professional work considerations of race and creed are irrelevant. A "quota" system applied to graduate schools, for example, would not guarantee that the most capable individuals would be admitted to the profession. On the contrary, such a system would set up a wholly arbitrary criterion and would violate the principles of democracy which must be maintained if psychology in America is to prosper.

The proposal for a "quota" system debases a profession which prides itself upon its respect for the individual person and upon its ability to select and train individuals for scientific work and for public service purely on the basis of merit.

Whether applied openly or surreptitiously, quota systems are therefore repugnant to the members of the Eastern Psychological Association and are condemned. The Association consequently disapproves an editorial paragraph in the *Journal of Clinical Psychology*, Vol. I, No. 1, January 1945, which implies support for a quota system in clinical psychology.

YES 370 (92%) NO 32 (8%)

2. I vote that copies of this resolution be sent to the Editor of the *Psychological Bulletin* (for publication if he is willing); to Dr. Thorne, editor of the *Journal of Clinical Psychology* (for publication if he is willing); to the Committee on Professional Ethics of the American Psychological Association, with the suggestion that this committee may wish to consider whether action is desirable.

YES 366 (91%) NO 35 (9%)

3. Should this resolution be given to the public press?

YES 256 (65%) NO 136 (35%)

4. Do you wish to have the Eastern Psychological Association establish a standing committee to examine public statements by psychologists bearing on the issue of racial and religious prejudice?

YES 250 (63%) NO 145 (37%)

SPECIAL COMMITTEE

E. G. BORING (ex officio)

J. G. PEATMAN

D. SHAKOW

G. W. ALLPORT, *Chairman*

PROCEEDINGS OF THE TWENTY-FIFTH ANNUAL MEETINGS OF THE WESTERN PSYCHOLOGICAL ASSOCIATION

RALPH H. GUNDLACH*

University of Washington

For the third year the Association dispensed with a coast-wide meeting, and encouraged local meetings in Seattle, the Bay Area and Los Angeles.

The meeting in the Bay Area was held on Saturday, June 23, in Berkeley at the University of California. Dr. Jean Walker Macfarlane was local chairman. Approximately 80 persons attended the sessions. The meeting in the Northwest was held on Saturday, June 23 in Seattle at the University of Washington. Dr. E. A. Esper was local chairman. The meeting in Los Angeles was held July 28 at the University of Southern California. Dr. Floyd Ruch was local chairman.

The officers of the Association still remain: President, Jean Walker Macfarlane, Institute of Child Welfare, University of California; Vice President, William Griffith, Reed College; Secretary-Treasurer, for a three year term, Lester F. Beck, University of Oregon, at present on leave.

PROGRAM OF THE BAY AREA MEETING

SESSION I

Saturday June 23

E. C. TOLMAN, Chairman

Differences Between Delinquent and Non-Delinquent Boys as Indicated by the Thematic Apperception Test. HOWARD WELLS, University of California.

The purpose of the study is to see what significant differences, if any, appear in the Thematic Apperception Test responses of two groups of boys. The one group is known to be delinquent and is considered to be quite disturbed, the other group has been matched with the first for age, IQ, and socio-economic status, but is considered well adjusted. All boys are under sixteen, and five pair of cases are Negroes. The responses have been scored according to the method developed by Murray and Sanford. The thematic productions of the experimental and control groups will be compared quantitatively in terms of feeling tone, outcome, need and press. Consideration will also be given to certain qualitative factors. There will be discussion of selected cases in which the TAT results are related to other relevant information.

Relaxation in Psychotherapy. DOROTHY H. YATES, San Jose State College.

The principal purpose of this report is to compare and discuss two methods of relaxation, that of Edmund Jacobson and an association-set procedure. Relaxation of muscles is an effective way of eliminating emotion, hence important. Objections are raised to Jacobson's method because of its length, difficulty, generality, undesirable meticulousness, and neglect of psychological factors. The association-set technique is essentially conditioning, but explanation, motivation, self-direction, etc., are also components. A word connoting relaxation, such as *peace*, *quiet*, or *calm*, is selected by the client; physical relaxation and calming associations are linked with this word; and there is a set, or

* Acting secretary-treasurer in the absence of L. F. Beck.

conviction, that at any future time recalling the key word will reinduce relaxation. While the technique is generally used in combination with other procedures, report is made on 24 cases in which association-set was used exclusively. The problems were single, uncomplicated ones, presented by persons who needed speedy help.

Some Responses of the Psychopath Interpreted in the Light of Lindner's Suggested Application of the Concept of Homeostasis. ROBERT B. VAN VORST, Preston School of Industry, Ione, California.

Lindner has recently suggested the application of the concept of homeostasis and the overflow procedure as the means of further interpreting and clarifying the behavior of the psychopath. The use of this concept gains support from findings that show overt behavioral criteria more clearly differentiate the psychopath from other delinquents than do his psychometric responses. In further support is the fact that the psychopath differentiates himself from delinquents with other mental disorders by the more predatory and violent nature of his anti-social acts.

Preference for Sex Symbols and Their Personality Correlates. KATE FRANCK, University of California.

In order to investigate the relationship between attitudes toward sex and personality structure, preference for male or female sex symbols was correlated with responses on a personality questionnaire. Pairs of pictures each showing one male and one female symbol were presented to 119 female undergraduates, who indicated their "aesthetic" preference in each pair. Scores were assigned to the female symbols. The group was divided into a low and a high half. Relationships between responses to each of the questionnaire items and both the score groups were tested by the Chi Square method. Sixteen questionnaire items proved significant on the 5% level or better. Considering all of these differences together, it was concluded that girls preferring male symbols were more mature, i.e., accepted their role as women and accepted men as their counterpart, while girls preferring female symbols were less mature.

Measured Personality Characteristics of Convulsive Therapy Patients: A Study of Diagnostic and Prognostic Criteria. R. E. HARRIS, Langley Porter Clinic.

Results of personality inventory (Minnesota Multiphasic) findings obtained before and after convulsive therapy are available for diagnostic groups (schizophrenia, manic-depressive, depressed, schizo-affective psychosis, involutional melancholia and severe psychoneuroses) and for prognostic groups (unimproved, improved, much improved, and recovered, following electric shock, insulin and electro-narcosis therapy). Patterns of the scores and their magnitudes differentiate both the diagnostic and prognostic groups. The diagnostic patterns follow in general the names of the scales as in the original standardization, with some more specific ratios increasing the agreement. Poor prognosis was found to be associated with a clinical diagnosis of schizophrenia or severe psychoneurosis and a pattern of high scores in the psychotic scales including psychasthenia.

Social Perception of Traits from Photographs. EGON BRUNSWIK, University of California.

Psychology classes totalling 95 subjects judged standardized photographs of 46 Army STP students (IQ approximately 90 to 140) unknown to them. Correlating "real" traits (mutual ASTP ratings, for intelligence also tests) with corresponding average intuitive estimates shows *social perceptual validity* ("achievement") to be negligible for intelligence (under .10), statistically significant for personality traits such as energy and likeability (about .35). Goodlookingness yields .65. *Halos* among judgments are strong,

and unrealistic considering low corresponding real-trait relationships (added in parenthesis): intelligence with energy, .84 (.28); with likeability, .62 (.01); with goodlookingness, .59 (.05). Among possible cues, height (stature) correlates .25 with intuited intelligence; if confirmed, this possibly indicates utilization of low but established height-IQ relationship of about .15 also found here. Among facial features, forehead-height shows only .18 (compare with popular prejudice!) versus .22, nose-height .20 versus .13.

SESSION II

Saturday June 23

E. R. HILGARD, Chairman

Certain Aspects of 551 Cases Brought Before the Separate Women's Court of San Francisco. MARY C. VAN TUYL, Separate Women's Court, San Francisco.

Psychometric examinations are given to all women who are brought into the Detention Ward located in the Public Health Building. Results for the 551 women appearing before the Court in the 6 months between Feb. and Sept. of 1944 were tabulated against the following factors: Race, age, state of birth, limits of formal schooling, length of time in California, presence of venereal disease in infectious stage at time of arrest, and, history of venereal disease infection. An attempt was also made to appraise degree and relation of the factors to alcoholism, drug addiction, promiscuity, and prostitution, and to tabulate these factors against mental level. Differences of distribution in mental level in the white and colored cases show plainly that the data from these two groups should be handled separately, i.e., whenever mental level is one of the pattern factors to be considered.

Civilian Testing, California Quartermaster Depot. PHYLLIS F. BARTELME, Chief, Employee's Testing Section.

Testing as an aid to personnel management; relationship of testing to staff and operating units; organization and operation of the Testing Section; scope of testing, approved testing and equipment; application and uses of testing.

Do Scale Constructors Use the Method of Equal Appearing Intervals? PAUL R. FARNSWORTH, Stanford University.

Studies of the frame of reference employed by subjects who are asked to prejudice attitudinal items by the Thurstone method show that approximately two-thirds of the members of one judging group did not regard each rating step as midway between the immediately contiguous steps. Each scale value was regarded rather as simply "more than" or "less than" its closest neighbor. When subjects were requested to check the attitudinal extremes on a militarism-pacifism line-continuum a sizable number felt that the neutral point should not fall at the center of the continuum. A few failed to accept a straight line as an adequate representation of the attitudinal continuum. The data of these experiments tend to invalidate the idea that in prejudging attitudinal items all or even most judges employ as their judgmental frame of reference the method of equal appearing intervals.

Permissible Coarseness of Grouping. RHEEM F. JARRETT, University of California.

Statistics computed from grouped data are obviously more unreliable than those computed from ungrouped data, because errors of grouping are superimposed upon the errors of random sampling. Thus no universal answer may be given to the question as to the number or size of class intervals which should be employed in reducing a set of data. The answer will depend upon the extent to which the unreliability of the statistics is to be

permitted to be increased over the irreducible minimum of sampling unreliability. The work of Fisher on the standard error of grouping and that of Tippett and others on the sampling distribution of the range provide information necessary to the computation of tables from which may be determined the size of interval to be employed if confidence is to be entertained that grouping errors shall not increase the standard error of mean or of standard deviation by more than some specified proportion of the standard error of random sampling. Justification is found in these tables for some of the rule-of-thumb procedures commonly employed by psychologists for sample sizes usually found in psychological studies.

Some Neglected Aspects of Test Efficiency. FRANKLIN M. HENRY, University of California.

The inadequacy of the validity coefficient r has been recognized by Taylor and Russell, whose *selection ratio* tables show that in some circumstances a validity coefficient of .50 may be more useful than one of unity. The reason for this emerges upon analyzing the scatter diagram. With a low incidence of criterion success the proportion of success in the selected group changes slowly until after the percent retained has approached the percent of unselected success. But if unselected criterion success is high, small amounts of selection result in relatively large improvements and the rate of improvement decreases with further selection. In counseling and guidance, the composition of the discarded group is of particular interest. Here, the proportion correctly placed by the test is high if unselected criterion success is low, but if it is high the proportion correctly placed is small and rapidly decreases as the percent discarded increases. In the latter case, validity must be quite high for a test to be useful.

Seasonal Variations in Growth. HAROLD E. JONES, University of California.

A public school sample, consisting of approximately 90 boys and 90 girls, was examined semi-annually over a period of seven years with a battery of tests of static dynamometric strength (right grip, left grip, pull, and thrust). The average age range was from 11 to 18 years. The puberal growth spurt for each individual was plotted with reference to seasonal incidence; maximum growth in strength was found to occur about twice as often in the spring as in the fall months. When average increments were referred to the months of the year, it was found that among girls about three-quarters of the total annual growth in strength occurred in the months of March, April, and May, with most of the remaining growth falling in the summer months. Among boys, differences were smaller in amount, but growth increments for April were significantly greater than for October. These results are in accord with other studies showing a greater velocity of growth in the spring, in height and in skeletal maturing.

PROGRAM OF THE SEATTLE MEETING

Saturday Morning, June 23

ROUND TABLE ON PSYCHOLOGICAL PROCEDURES IN PERSONNEL WORK

E. R. GUTHRIE. *Faculty Jury Rating Methods in the Determination of Teaching Effectiveness.*

LT. THEODORE BARNOWE. *Relation of Trade Tests to Morale Building.*

Saturday Afternoon, June 23

SYMPOSIUM IN CLINICAL PSYCHOLOGY

MIRIAM MURRAY, Chairman

LOREN BUNDAS, Catholic Children's Bureau. *The Projective Techniques—Their Values, Limitations, and Clinical Application.*

HAROLD M. HILDRETH, Naval Hospital. *Clinical Psychology in the United States Navy.*

RAMONA MESSERSCHMIDT, State Department of Social Security. *Contributions of the Psychologist to the Field of Social Work.*

VIRGINIA BLOCK, Child Guidance Department, Seattle Public Schools. *The Psychologist in the Public Schools.*

PROGRAM OF THE LOS ANGELES MEETING

Saturday Morning, July 28

CLINICAL PSYCHOLOGY

GILBERT BRIGHOUSE, Chairman

Visual and Auditory Perceptual Factors in a Group of Gifted Children. SARA STINCHFIELD HAWK, Scripps College.

Three groups of children were chosen from the Polytechnic Elementary and Junior High School in Pasadena ranging from the 2nd through 8th grade, for comparison along the lines of sensory and motor adaptation in the school situation. Group I represents all of the children referred this year from the grades mentioned for Remedial Reading; Group II is a control group of children equated for age, grade and intelligence, but with no reading difficulty; and Group III is another group from the same age, grade and approximate environmental set-up, but superior in oral reading and auditory perception, with no reading difficulty and in the highest IQ section of the class.

Conclusions: Most of the children in the remedial reading group were better on the visual than on the auditory perception side; some were best in auditory or motor. Control cases exceeded the remedial group not so much in a quantitative way as on qualitative performance. The third group, consisting of well-adjusted children with superior oral speech and auditory understanding were superior in varying degrees, in visual and auditory perception, and in verbalization.

The Use of the Rorschach Test Under Sodium Amytal and Under Hypnosis in Military Psychiatry. WALTER L. WILKINS, Lt. Comdr. H(S) USNR, and AUSTIN J. ADAMS, Lt. MC, USNR.

Certain types of cases for which the Rorschach technique provides a paucity of responses and for which the sodium amytal or hypnotic techniques reveal significant personal background materials show somewhat different Rorschach patterns when the test is administered under these conditions. Illustrative protocols are presented and comments on the technique are offered.

Standardizing the Interpretation of the Rorschach Responses. CHARLOTTE BUEHLER, Los Angeles County Hospital.

No abstract available.

Description of a Project in Group Therapy. DOROTHY W. BARUCH.

Group therapy was undertaken with a mixed group of 23 adults. The subjects were students enrolled in a course in "Techniques of Therapy." On the assumption that undergoing therapy themselves would best clarify and point up techniques for them, the students spontaneously elected to have such an experience. Twelve *therapeutic group discussion* sessions were held; one session in *therapeutic writing* and one in *psychodrama*. Observational notes were taken during the *therapeutic group discussion* sessions. Leadership techniques were then arrived at by the group, analyzed and summarized. Informal statements of growth were turned in. The present paper briefly describes the project,

gives illustrative excerpts from the observational records, summarizes leadership techniques and growth indicated.

Symposium on the Work of the Psychological Services Branch of the Convalescent Services Division of the AAF Redistribution Station Number 4. (1 hour)

LEE EDWARD TRAVIS, MAJOR AC AND GROUP.

The Psychological Services Branch consists of four sections: Orientation, Program Placement and Evaluation, Counseling, and Administration and Research. An officer is in charge of each section. Major Travis gave an over-all picture of the mission of the Psychological Services Branch outlining the general function of psychology in the Convalescent Services Division. This general discussion included procedures, policies, principles, and practices; the type of patient encountered, his present problems, his future army and post-war assignments. Each officer in charge of his section discussed briefly the functions and activities of his section showing how his work is related to that of the Branch as a whole and to the Convalescent Services Division program.

Afternoon Session, July 28

PENCIL AND PAPER MEASURES OF TEMPERAMENT
AND PERSONALITY

ROY DORCUS, Chairman

Recent Evidences of Validity of the Humm-Wadsworth Temperament Scale.

DONCASTER G. HUMM.

No abstract available.

A Brief Statement Concerning the Effectiveness of the Humm-Wadsworth Temperament Scale. JAMES L. FULTON, Lt. Los Angeles Police Department.

Six hundred and six members of the Los Angeles Police Department were tested by means of the Humm-Wadsworth Temperament Scale. Of these, 115 were regular employees, 48 had earned promotion to staff positions, and 506 were war emergency appointments. (348 are still employed, 55 resigned voluntarily, and 103 were discharged.) All of these were rated as follows: Very Good, Good, Doubtful, Poor, or Very Poor.

War Emergency Policemen

Humm-Wadsworth Rating	Still Empl.	Resigned	Discharged	Reg. Police	Staff Members
Fair or better	14%	26%	1%	38%	61%
Doubtful or worse	86%	74%	99%	62%	39%

These findings show an agreement between the quality of the employees and the findings of the Humm-Wadsworth Temperament Scale. Inasmuch as temperament is behavior tendency and not behavior, the most significant finding is that with discharged policemen, since behavior tendency is here identified with resultant behavior.

Ability of Adults to Fake Desirable Responses on Two Personality Self-Inventories and an Attempt to Develop a "Lie Detector" Key. FLOYD RUCH, University of Southern California.

Pencil and paper self-inventories are easily influenced by the average adult. To overcome this limitation a "Lie-detector" key was developed. It was assumed that the person who tries to influence his score will succeed better on the easy-to-influence than on the hard-to-influence items. Therefore Total Adjustment Scores on the California Test of Personality Adult Form A were corrected by multiplying them by the ratio

of the correct answers earned on the hard-to-influence items over the number of correct answers on the easy-to-influence items. The validity of the correction method was tested by administering the test to a group of 155 persons under the clinical and the employment conditions. Each blank was scored to yield an uncorrected score, a correction factor, and a corrected score. The mean of the uncorrected scores for the clinical condition equalled 132 (55th percentile rank); whereas the mean of the employment scores equalled 160 (94th percentile rank). When the correction factor was applied the means became 164 and 166 respectively.

Insight of College Students into the Items of a Personality Test. MORRIS KIMBER, University of Southern California.

Problem: The present investigation was carried out to discover the extent of college students' insight into the items on a test of personality to discover possible relationships between this insight and other identifiable traits or characteristics of personality.

Procedure: The California Test of Personality was twice administered to approximately 400 students registered in a beginning course in psychology at the University of Southern California. On the first occasion students were instructed to answer the questions as they believed that a happy and well-adjusted student at Southern California would answer them. On the second occasion students answered for themselves. The Army Alpha Examination, a test of intelligence, was later administered to the group.

Conclusions: Students differ greatly in the amount of insight which they possess. Most students secured high scores on the first test and low scores on the second. A high degree of insight is regarded as responsible for this difference.

PANEL DISCUSSION

Discussion of the above papers and topics by: GLEN GRIMSLEY, Supervisor of Testing, Lockheed Aircraft Corp.; LEBARON STOCKFORD, Industrial Relations Analyst, Lockheed Aircraft Corp.; BEN S. TRYNNIN, Director of Industrial Relations Research, Merchants and Manufacturers Association of Southern California.

PSYCHOLOGY AND THE WAR

Edited by
DONALD G. MARQUIS

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PRESENT ORGANIZATION, POLICIES, AND RESEARCH ACTIVITIES OF THE AAF AVIATION PSYCHOLOGY PROGRAM

STAFF, PSYCHOLOGICAL BRANCH

*Office of the Air Surgeon
Headquarters Army Air Forces
Washington, D. C.*

This article is the eighth in a series describing the Aviation Psychology Program of the Army Air Forces. Seven previous articles (1, 2, 3, 4, 5, 6, 7) have dealt with the Aviation Psychology Program as of October 1943; history, organization, and procedures at Psychological Research Unit No. 1; research program on psychomotor tests at Psychological Research Unit No. 2 and the Department of Psychology, School of Aviation Medicine; organization and research activities of Psychological Research Unit No. 3; the Aviation Cadet Qualifying Examination; history, organization, and research activities of the AAF Psychological Test Film Unit; and psychological activities in the AAF Training Command. The purpose of the present article is to describe the organization and functions of the AAF Aviation Psychology Program as of the thirtieth of June 1945, to present the basic research policies and postulates of this program, and to present a brief sketch of the research mission of the various units of the Aviation Psychology Program. It is planned that future numbers of this series will deal with the activities of certain units outlined in this article and not described in detail in previous reports.

FUNCTIONS OF THE AVIATION PSYCHOLOGY PROGRAM

The general functions listed for the Aviation Psychology Program appear in AAF Regulation No. 20-59. This Regulation states that the Aviation Psychology Program will carry out the following types of activities,

- a. Development and refinement of an Army Air Forces Qualifying Examination, to be used in screening applicants for aircrew duty.
- b. Development and refinement of a battery of tests for the original classification of men for the various types of aircrew assignments, and administration of this battery to applicants for aircrew training.
- c. Development of procedures and tests for supplementary classification and utilization of aircrew members and of complete crews for leads, instructor, or other special assignments and administration of these tests to appropriate groups.
- d. Provision of technical assistance in the development of improved proficiency measures for use in evaluating selection procedures and the results of training.
- e. Follow-up of personnel in training, operational training, and combat to determine what measures of aptitude or proficiency are effective in predicting later success.
- f. Interviewing, testing, and counselling combat returnees in convalescent hospitals to assist in the planning of appropriate convalescent activities for returnee personnel.
- g. Investigation of variations in training materials and procedures, as requested by training authorities, in order to permit improvements in training procedures.

In addition to these functions, research is planned and several studies are underway concerning problems of aviation equipment. Proposed studies include the investigation of specific design problems and the determination of general principles in the use of equipment. Several projects concerned with standardization of the aircraft cockpit have been completed.

The carrying out of these general functions and also of more specific ones listed in various other official publications as presented below is assigned to a large number of units as will be described in some detail in later paragraphs.

PRINCIPLES UNDERLYING THE AVIATION PSYCHOLOGY PROGRAM

The Aviation Psychology Program represents an experiment in coordinated research in psychology. For this reason it seems desirable to set forth the hypotheses and decisions underlying the planning and organizing of the program and also some of the operating procedures and principles which have been developed as a result of the experience of the past four years.

The two principal reasons, historically, why a coordinated research program was developed rather than a single strong centralized group or a number of relatively independent units were (1) the natural army framework which emphasizes the separation of policy-making and operations and (2) the decision that the research program should be intimately associated with the service or operating activities. This decision was based on the idea that research personnel should avoid participation in activities not essential to research, but should be close enough to field activities to obtain a clear picture of operational problems.

Other ideas which were postulated in developing the original plans for the Aviation Psychology Program are given below. The first of these ideas led to the decision to concentrate on *research* rather than *service*. This point was that personnel with professional training in psychology and scientific methods can make their greatest contribution by doing research on the psychological aspects of fundamental problems of design of military equipment, personnel selection, classification, training, and the utilization of personnel in operations.

Although such professional personnel would doubtless render valuable service as instructors, interviewers, technicians, examiners, statisticians, executives, and administrators, it was believed that their abilities are more adequately utilized in developing new techniques and establishing new facts as the basis for revision of general policies and procedures.

The other fundamental postulate was that the research program should be carefully planned and articulated. The broad plan for research was in terms of areas of activity rather than specific projects since the process of developing procedures was regarded as a continuous evolution and final solutions were not expected. It was believed that the planning and the delegation of responsibility for specific areas of research should be based on comprehensive knowledge of the total situation. This should include such information as is usually available only in the highest headquarters concerning general plans, requirements, and problems, and the special abilities of the personnel available to do this work.

The experience of the past few years indicates that delegation of responsibility for a broad area for research together with a system of circulating proposals and reports, including progress reports, enables the supervisors in headquarters to make sure that the problems and responsibilities are clearly understood and makes it possible for experts in other units to contribute to projects in which they are interested and to profit from current findings.

The supervision of the projects by means of review of reports, priorities and deadlines has as its primary purpose the obtaining of research findings which can be immediately translated into action. Experience indicates that research studies instigated at the request of higher headquarters or developed in cooperation with them are much more likely to result in action than studies carried out in the field without any appreciation of a need for information on the part of higher headquarters.

In selecting areas for research and establishing priorities the following factors are usually considered in the order indicated: (1) military importance, (2) immediacy of effect, (3) likelihood of conclusive findings, and (4) facilitation of other work.

On the basis of the above considerations early research effort (July 1941 to July 1943) in the Aviation Psychology Program was concentrated almost exclusively on selection and classification of aircrew personnel. This area was selected because it was believed that the greatest contribution to the effectiveness of the AAF in this war could be made by the immediate development of procedures for selecting in advance those individuals who would later be found most successful in the flying training schools. It was thought that changes indicated by research findings concerning the design of instruments and operating controls for planes would meet with considerable resistance since the planes were already in production and there was heavy pressure to meet production schedules. Similarly training procedures were established and the efforts of supervisory personnel were fully occupied in expanding the existing training program.

During the initial period of the program, this country was not engaged in combat operations and for some time after this country's entrance into the war, such a small number of personnel were deployed that substantial research in this area was impractical. It was not until combat operations had increased in scope and become more stabilized in type that a significant amount of research could be done on the problem of greatest ultimate importance—the identification of the critical requirements of combat operations. The critical requirements are defined as those which are crucial in the sense that their

presence or absence determines the success or failure of an appreciable number of combat missions. Such requirements refer to procedures in all of the general areas of research listed above. Without knowledge of combat effectiveness it is difficult to do definitive research in any of these areas.

The fact that a large proportion of aircrew personnel were eliminated in training afforded an immediately available if not entirely valid criterion for selection and classification procedures. The thorough and repeated evaluations on which graduation and elimination were based did seem to provide a valuable basis for initial research. Furthermore, if selection procedures were not developed relatively early it would be impossible to validate them against combat success.

By July 1943, considerable progress had been made with regard to the problems of selection and classification and the approval of the staff of the Commanding General, Army Air Forces was obtained to extend the research program of Aviation Psychologists to include problems of evaluation of aircrew proficiency, training, redistribution, and combat operations. This led to the establishment of a number of new units in the Training Command, the Personnel Distribution Command, and later in the Continental Air Forces. The functions and general nature of the various component groups of the Aviation Psychology Program including these new units are briefly described in the following sections.

ORGANIZATION, FUNCTIONS, PERSONNEL AND RESEARCH PROJECTS

The accompanying organization chart presents a schematic diagram and over-all picture of the activities of the Aviation Psychology Program, including the titles of the various units and their addresses. The paragraphs that follow present a more detailed breakdown of this organization chart, including a listing of major functions, officer personnel, and typical projects of particular units. The following discussion is divided into seven major sections, headed as follows: Headquarters, Army Air Forces; AAF Training Command; AAF Personnel Distribution Command; AAF School of Aviation Medicine; Continental Air Forces; AAF Aero-Medical Laboratory; and Overseas Units.

1. *Headquarters, Army Air Forces, Office of the Air Surgeon, Research Division, Psychological Branch.* The function of this organization is policy formation, planning, coordination, and over-all supervision of the Aviation Psychology Program. The specific functions listed for the Psychological Branch are as follows:

1. Supervises the development and refinement of the initial selection test, the AAF Qualifying Examination.
2. Determines, coordinates, and controls the battery of tests for the classification of men for the various types of aircrew assignment; and supervises the administration and validation of these tests for the purpose of determining the type of duty for which individuals are best suited.
3. Investigates and recommends assignment of personnel to effect the selection and classification of aircrew.
4. Supervises and coordinates the Aviation Psychology Program in the AAF with regard to both operating activities and research functions.
5. Maintains liaison with research activities related to aviation psychology in military and civilian organizations in the United States and Allied nations.

Dissemination of information concerning psychological activities and research in agencies outside of the Aviation Psychology Program is achieved by

by means of the *Aviation Psychology Abstract Series* prepared by Dr. William O. Jenkins of the Psychological Branch.

The Chief of the Psychological Branch is Colonel John C. Flanagan, and the personnel are Major Robert L. Thorndike, Major Anthony C. Tucker, and Dr. William O. Jenkins.

II. AAF Training Command. The Psychological Section, Office of the Surgeon, Headquarters, AAF Training Command, is responsible for supervision of the Aviation Psychology Program within that Command. In addition an IBM installation used for maintaining records is located here (7). The specific functions for this Command as listed in AAF Letter 20-101 may be enumerated as follows:

a. Administration of a battery of aptitude tests to applicants for aircrew training to determine the specialties for which each man is qualified, and preparation of recommendations for aircrew assignment.

b. Administration of tests of aptitude and proficiency to special groups of aircrew trainees and graduates, to be used in determining further classification and special assignment, as may be directed by Headquarters, AAF. Preparation of recommendations for assignment of these personnel.

c. Development of new aircrew aptitude tests, administration of these tests for research purposes to appropriate groups of aircrew applicants and trainees, and systematic follow-up to determine the effectiveness of these tests in predicting success in aircrew training.

d. Maintenance of systematic records of test results and training success and carrying out analyses of these data and of their relationships.

e. Development and improvement of objective methods of evaluating proficiency in the various aircrew specialties.

f. Experimental study of variations in training procedure, in accordance with the needs of training personnel, in order to permit improvements in training procedures.

The Officer personnel of the Psychological Section, Headquarters, AAF Training Command, are as follows: Colonel Frank A. Geldard (Chief), Lt. Colonel A. Paul Horst, Lt. Colonel Walter L. Deemer, Major Philip H. DuBois, Major Beverly von Haller Gilmer, Major S. Rains Wallace, Captain Armen A. Alchian, Captain Leonard Berwick, Captain George B. Simon, 1st Lieut. Julien V. Weston, 1st Lieut. James W. Dawson and CWO James Ozburn.

The mission of carrying out of the functions listed above is assigned to a number of specific units as may be seen from the organization chart. The units of the Training Command are treated briefly in the following paragraphs.

Psychological Research Unit. This unit is responsible for classification test development, administration, and validation.

The Chief of the Psychological Research Unit is Lt. Colonel J. P. Guilford, and the officer personnel are Major William E. Walton, Captain Frank H. Boring, Captain Lloyd G. Humphreys, 1st Lieut. William A. McClelland, 1st Lieut. John T. Cowles, 1st Lieut. John T. Dailey, and 1st Lieut. John I. Lacey. Dr. M. A. Wenger has also been associated with the PRU in connection with psycho-physiological studies.

Psychological Examining Units. The functions of the Psychological Examining Units include the administration of the aircrew selection and classification battery to applicants for aircrew training, the scoring of these tests, and the making of recommendations to the appropriate authorities concerning the qualifications of applicants.

The officer personnel at the various PEU's are as follows: *Psychological Examining Unit, Keesler Field, Mississippi*: Captain Walter F. Grether, (Chief), 1st Lieut. Fred H. Rohles, Jr., 1st Lieut. John H. Straka, 1st Lieut. Evan L. Wolfe, and 2nd Lieut. David Holt. *Psychological Examining Unit, Buckley Field, Colorado*: Captain Jay R. Brick, Captain Joseph E. King, Jr., Captain William F. Long, Captain Francis H. Thomas, 1st Lieut. Franklin Bacon, Jr., and 1st Lieut. Solomon S. Lieberman. *Psychological Examining Unit, Amarillo, Texas*: Captain Philip I. Sperling (Chief), Captain Mybert E. Broom, Captain Vergil M. McIntosh, 1st Lieut. Zed H. Burns, 1st Lieut. Wilbur R. King, and 2nd Lieut. Norman E. Michel, Jr. *Psychological Examining Unit, Maxwell Field, Alabama*: Captain Reuben A. Baer (Chief), 1st Lieut. Malcolm G. Dickinson, and 2nd Lieut. John E. French.

Psychological Test Film Unit. The PTFU is responsible for the development of motion picture selection, classification, and proficiency tests. In addition, considerable work has been done by this unit on problems of aircraft recognition and the use of motion pictures as educational and training devices.

The Chief of the PTFU is Major James J. Gibson, and the officer personnel are 1st Lieut. Ralph M. Eisenberg, and 1st Lieut. Robert M. Gagne.

Psychological Research Project (Pilot). The functions of PRP (Pilot) include the development of pilot proficiency measures, research in the selection of instructors, and training research in the pilot area. Specific research projects are under way on the development of an objective scale of flying skill, the development and validation of instructor selection tests, the development of pencil-and-paper proficiency tests, and the study of various criteria of pilot performance.

The officer personnel of this unit are Major Neal E. Miller (Chief), Captain William V. Hagin, Captain Richard P. Youtz, 1st Lieut. Stanford C. Erickson, 1st Lieut. William E. Galt, 2nd Lieut. Harold H. Hagy, and 2nd Lieut. Ralph E. Showalter.

Psychological Research Project (Navigator). PRP (Navigator) is responsible for research in proficiency measurement, training, and instructor selection in the area of aerial navigation. Specific projects include the evaluation of certain navigation training devices, the development of pencil-and-paper proficiency tests, and the study of criteria of navigator proficiency and instructor performance.

The personnel of this unit are Captain Launor F. Carter (Chief), 1st Lieut. Frank J. Dudek, 1st Lieut. Seymour T. Friedman, 1st Lieut. Ruby E. Michael, and 1st Lieut. William A. Zielonka.

Psychological Research Project (Bombardier). The functions of PRP (Bombardier) include research on proficiency measures and on instructor selection, and training research studies of certain bombardier activities. Specific projects include the development, administration, and analysis of proficiency tests; development of measures of proficiency in aerial bombing; validation of bombardier instructor selection tests; and experimental investigations of various phases of the bombardier's activities.

The Chief of this unit is Major Edward H. Kemp, and the officer personnel are Captain Albert P. Johnson, 1st Lieut. William W. Grings and 1st Lieut. Stanley F. Swenson.

Psychological Research Project (Radar). PRP (Radar) is responsible for the development and tryout of selection tests and proficiency measures for

airborne radar observers. Specific research projects include job analysis, validation of printed and apparatus tests, and research in instructor selection.

The Chief of this unit is Captain Stuart W. Cook, and the officer personnel are Captain Horace R. Van Saun, 1st Lieut. Stuart Lottier, 2nd Lieut. Lewis G. Carpenter, Jr., and 2nd Lieut. George S. Klein.

Psychological Research Project (Combat Crew). The functions of PRP (Combat Crew) include the making of recommendations concerning the matching of individuals for bombardment crews and also concerning which crews will be designated as potential lead crews. This unit was recently activated, and research plans call for studies of variables entering into the lead crew aptitude score and the preparation of research data for use by the Continental Air Forces.

The Chief of this unit is Major William M. Lepley, and the officer personnel are 1st Lieut. Avrum H. Ben-Avi, 1st Lieut. Maurice Deigh, 1st Lieut. Byron B. Harless, and 1st Lieut. Sol M. Roshal.

Psychological Research Project (Flight Engineer). This project has been activated very recently for purposes of performing research on the selection and training of flight engineers for B-29 Superfortresses. Research plans call for the development of selection and proficiency tests and their comparison with the various relevant criteria.

The officer personnel of this unit, headed by Major Neil D. Warren, will include 1st Lieut. John T. Cowles, 1st Lieut. John T. Dailey, and 1st Lieut. William A. McClelland.

III. AAF Personnel Distribution Command. The primary function of the Psychological Division, Office of the Surgeon, Headquarters, AAF Personnel Distribution Command, is supervision of the Aviation Program under the authority of that Command. Specific functions listed for the Command in accordance with AAF Letter 20-102 are as follows:

a. Administering tests to returned combat personnel to evaluate aptitude for certain special assignments, such as instructor or administrative officer, as directed by the Commanding General, AAF.

b. Interviewing, testing, and counselling returned combat personnel in convalescent hospitals to assist in the planning of appropriate convalescent activities for each individual.

c. Gathering information concerning combat effectiveness of individuals, for use in validating initial classification testing procedures.

d. Gathering information concerning psychological problems and psychological requirements for combat flying, as these are reported by returned combat personnel.

e. Carrying out such additional research studies as the Commanding General, AAF may direct.

It is also the function of the Personnel Distribution Command to prepare forms of the AAF qualifying Examination.

The Aviation Psychology Program in the AAF Personnel Distribution Command is headed by Lt. Colonel Laurance F. Shaffer, and the officer personnel at Headquarters are Major Merrill T. Roff and Captain Sidney W. Bijou.

AAF Redistribution Stations. There are Psychological Branches at the six Redistribution Stations, as may be seen from the organization chart. These units administer instructor selection tests and combine the results into com-

posite instructor scores, and are responsible for such specific research projects as combat validation of initial classification test scores, studies of leadership, and other research projects of this nature.

The officer personnel at the six stations may be listed as follows. *Redistribution Station No. 1, Atlantic City, New Jersey*: Captain Clarke W. Crannell (Officer in Charge), and Captain Donald W. Troy. *Redistribution Station No. 2, Miami Beach, Florida*: Major Frederic Wickert (Officer in Charge), Captain William G. Mollenkopf, and 2nd Lieut. Marquis A. Kirk. *Redistribution Station No. 3, Santa Monica, California*: Captain Merrill T. Hollinshead (Officer in Charge), 1st Lieut. Reuben Resnikoff, and 1st Lieut. William C. Stevens. *Redistribution Station No. 4, Santa Ana, California*: Captain Chester W. Harris (Officer in Charge), 2nd Lieut. James F. Kamman, 1st Lieut. Joseph R. Royce, and 1st Lieut. Malcolm J. Williams. *Redistribution Station No. 5, Camp Davis, North Carolina*: Captain Frederick B. Davis (Officer in Charge), and Captain Robert E. Murphy. (As an additional function, Captain Davis is responsible for constructing new forms of the AAF Qualifying Examination.) *Redistribution Station, Greensboro, North Carolina*: 1st Lieut. John P. Carlson.

AAF Convalescent Hospitals. Psychologists in the Convalescent Hospitals of the AAF Personnel Distribution Command are assigned to the Psychological Services Branch and are responsible for orienting, interviewing, testing and counselling returned combat personnel to assist in the planning of appropriate convalescent activities for each individual and as an aid to medical treatment, and research in these areas.

The eleven stations and the officer personnel assigned to them are listed below: *Convalescent Hospital, Bowman Field, Kentucky*: Captain Glen L. Heathers (Officer in Charge), Captain Robert L. Clougherty, 1st Lieut. Paul R. Diller, 2nd Lieut. John K. Hemphill, 2nd Lieut. Joseph J. Johnston, 2nd Lieut. John F. MacNaughton, 2nd Lieut. Clarence F. Willey, and WO (JG) Clark J. Kujawsky. *Convalescent Hospital, Ft. Logan, Colorado*: Lt. Colonel Hermann O. Schmidt (Officer in Charge), Captain Franklin C. Vaughn, 1st Lieut. Orval R. Johnston, 1st Lieut. William M. Wise, 2nd Lieut. Albert F. Ax, 2nd Lieut. Dwane R. Collins, 2nd Lieut. George J. Fortune, 2nd Lieut. Robert J. Keller, and 2nd Lieut. Ralph M. Rust. *Convalescent Hospital Miami Beach, Florida*: Captain Donald E. Super (Officer in Charge), Captain Chester W. Grochola, 2nd Lieut. Meredith W. Darlington, 2nd Lieut. Louis Delman, 2nd Lieut. Arthur L. Irion, 2nd Lieut. Douglas H. Lawrence, 2nd Lieut. Leslie L. Martin, 1st Lieut. Daniel D. Raylesberg, and 2nd Lieut. Frederick G. Tice. *Convalescent Hospital, Plattsburg Barracks, New York*: Major Edward I. Strongin (Officer in Charge), Captain Harry O. Ellison, 1st Lieut. Cecil C. Stewart, 2nd Lieut. David H. Jenkins, 1st Lieut. Herbert L. Rooney, and 2nd Lieut. A. J. Schmitt. *Convalescent Hospital, Santa Ana, California*: Major Lee E. Travis (Officer in Charge), 1st Lieut. Theron C. Bird, 1st Lieut. Joseph C. Cole, 1st Lieut. William H. Lucio, 1st Lieut. John W. Stephens, 2nd Lieut. Thomas F. Bell, 2nd Lieut. Isadore E. Farber, 2nd Lieut. Austin E. Grigg, 2nd Lieut. Dorothea E. Hilliard, and 2nd Lieut. Joseph L. Woodruff. *Convalescent Hospital, St. Petersburg, Florida*: Major George Forlano (Officer in Charge), Captain Stanley P. Berney, 1st Lieut. Martin Brown, 2nd Lieut. Seymour Klebanoff, and 2nd Lieut. Eli A. Lipman. *Convalescent Hospital, Ft. Thomas, Kentucky*: Major Harry V. McNeill (Officer in Charge), Captain Seymour P. Stein, 1st Lieut. Edward G. Brodie, 2nd Lieut. Robert Grice, 2nd Lieut. Charles W. McCracken, and 2nd Lieut. Gerald R. Pascal. *Convalescent Hospital, Ft. George Wright, Washington*: Major Henry Obel (Officer in Charge), Captain George A. Tyler, 1st Lieut. Gerald A. Ehrenreich, 2nd Lieut. Bert R. Sappenfield, 2nd Lieut. William B. Schrader, 2nd Lieut. William M. Wheeler, and 2nd Lieut. George J. Wischner. *Convalescent Hospital, Camp Davis, North Carolina*: Major Milton B. Jensen (Officer in Charge), 2nd Lieut. Garth J. Thomas, 2nd Lieut. Llewellyn N. Wiley, and

2nd Lieut. Benjamin Willermann, 1st Lt. Francis A. Winiarz, and 2nd Lt. Julian B. Potter, *Convalescent Hospital, Pawling, New York*; 1st Lieut. Morton Deutsch, *Convalescent Hospital, Cochran Field, Georgia*; Major Nicholas Hobbs (Officer in Charge) and 2nd Lieut. Thomas P. Gallagher.

IV. *AAF School of Aviation Medicine.* The Department of Psychology in the AAF School of Aviation Medicine includes a number of Aviation Psychologists who are responsible for the development of apparatus tests for use in selection, classification, and proficiency measurement. Other research areas include the study of selection procedures and measurement of proficiency in the area of aerial gunnery and studies of aircraft cockpit requirements with a view to improving the cockpit for ease, speed, and accuracy of responding to the various instruments and controls.

The Department of Psychology is headed by Lt. Colonel Arthur W. Melton and the Aviation Psychologists in this Department are as follows: Captain Judson S. Brown, Captain Jack Buel, Captain Glen Finch, Captain Moncrieff H. Smith, Jr., 1st Lieut. Joseph Weitz, and Dr. Roger B. Loucks.

V. *Continental Air Forces.* The Continental Air Forces consist of the four Air Forces in the United States and the Headquarters at Bolling Field, D. C. Psychological personnel are assigned to these five organizations and are responsible for the study of the performance of aircrew members in operational training in the Zone of the Interior and follow-up studies of initial selection and classification tests at this stage of training. The specific functions which are listed for the Aviation Psychology Program in the Continental Air Forces in AAF Letter 20-103 are as follows.

a. Making available to commanding officers existing psychological test records, proficiency test scores, and training records, and advising concerning the use of such information in the selection of personnel for lead crew and other special types of operational training.

b. Devising and/or administering aptitude and/or proficiency tests for the purpose of securing additional information to be used in the selection of personnel for special training.

c. Developing measures and/or collecting data on the proficiency of individuals and/or combat crews to be used in evaluating the accuracy of selection procedures.

d. Undertaking additional research studies that may be directed by the Commanding General, AAF or the Commanding General, Continental Air Forces.

Headquarters, Continental Air Forces, Psychological Research Section, Office of the Surgeon. This unit has been activated recently and is headed by Major Meredith P. Crawford. This section is responsible for supervision of research in the Psychological Sections of the four Continental Air Forces. It is planned that additional officer personnel will be assigned to this unit.

Headquarters, First Air Force, Psychological Research Section, Office of the Surgeon. This unit is headed by Lt. Colonel Richard T. Sollenberger, and the area in which research is most heavily concentrated is the study of fighter pilots, including validation of initial selection and classification procedures against various criteria. The officer personnel in this organization are as follows: Captain Howard D. Hadley, Jr., Captain Richard H. Henneman, and 1st Lieut. Wilse B. Webb.

Headquarters, Second Air Force, Psychological Research Section, Office of the Surgeon. This section specializes in research activities on follow-up studies of

bomber crews. The Chief of the unit is Major Lewis B. Ward, and its officer personnel are as follows: Captain Marion H. Brown, Captain Philip H. Mitchell, 1st Lieut. Frank E. Killian, and 1st Lieut. Philip Nogee.

Headquarters, Third Air Force, Psychological Research Section, Office of the Surgeon. This unit, under the direction of Major Clarence W. Brown, is responsible for research concerning crew formation, returnee utilization, and leadership. The officer personnel are: Major George F. Lehner, Captain Vernon J. Bentz, and Captain John J. DeMott, Jr.

Headquarters, Fourth Air Force, Psychological Research Section, Office of the Surgeon. This section is responsible for research on the selection, classification, and proficiency of night and two-engine fighter pilots in operational training. The Chief of this unit is Major Edwin E. Ghiselli, and the officer personnel are 1st Lieut. Roger W. Heyns, 1st Lieut. Robert B. Payne, and 1st Lieut. John W. Thibaut.

VI. *Psychological Branch, Aero-Medical Laboratory, Air Technical Service Command.* A unit of the Aviation Psychology Program has recently been activated at the Aero-Medical Laboratory. This unit is headed by Lt. Colonel Paul M. Fitts, Jr., and plans call for the assignment of a number of officers and enlisted men to this organization. The major mission of this unit is the study of aviation equipment in relation to the personnel which use it.

VII. *Overseas Units.* A number of units, entitled Aircrew Evaluation and Research Detachments, and several individuals have been assigned to overseas Air Forces on temporary duty for a number of months from the Aviation Psychology Program. These groups and individuals have been assigned specific responsibility for various areas of research and collection of combat information for validation against selection and classification tests. Much valuable information has been collected with regard to problems of combat duty and operations, and particularly with regard to the validation of initial selection and classification procedures against various measures of combat performance.

Units have been assigned to the European Theater of Operations, the Mediterranean Theater of Operations, and the Pacific Ocean Areas, under the direction of Lt. Colonel A. Paul Horst, Major Neil D. Warren, and Major William M. Lepley, respectively. The officer personnel of these AERD's include: Major B. von H. Gilmer, Captain Leonard Berwick, Captain Jay R. Brick, Captain Stuart W. Cook, Captain Glen L. Heathers, Captain William F. Long, Captain William G. Mollenkopf, 1st Lieut. Avrum H. Ben-Avi, 1st Lieut. William W. Grings, 1st Lieut. Byron B. Harless and 1st Lieut. Sol M. Roshal. Approximately twenty-five enlisted men also served overseas with these units. Individual officers who have served overseas as representatives of the Aviation Psychology Program are Colonel John C. Flanagan, Lt. Colonel Paul M. Fitts, Jr., Major Philip H. DuBois, Captain Roger W. Russell, and 1st Lieut. Wilse B. Webb.

SUMMARY OF DEVELOPMENTS IN ORGANIZATION AND RESEARCH

It appears to be in point to summarize the foregoing discussion with regard to changes in organization and in research orientation of the Aviation Psychology Program since its inception in July 1941. It can be gathered from previous discussions that the scope of the Aviation Psychology Program in its research orientation and operating services has enlarged broadly from its original aims of selection and classification for purposes of recommending assignments of individuals most likely to succeed in training, to include such areas of research as proficiency, training, special assignments, combat validation, clinical

evaluations and testing, and studies of aviation equipment. Concomitantly there has been considerable change in the organizational structure of the Program with the creation of a large number of units to handle new research problems. At the present time, there are seven general organization headings subsuming the research purposes and area of the Aviation Psychology Program: Headquarters, Army Air Forces; Headquarters, AAF Training Command; AAF Personnel Distribution Command; AAF School of Aviation Medicine; Continental Air Forces; Aero-Medical Laboratory; and Overseas Units.

PERSONNEL

At the present time, approximately two hundred commissioned officers are assigned as Aviation Psychologists in the AAF Aviation Psychology Program. There are approximately seven hundred and fifty enlisted men, many of whom have Bachelor's or Master's Degrees in the field of psychology or education. The loyalty and hard work of these men made possible the achievements of the program. Space does not permit the listing of their names or the many important contributions made by them as individuals.

FUTURE PLANS

Research will continue in the fields of selection and classification, training, aviation equipment, and the other areas cited above. Efforts are being concentrated on the measurement and evaluation of proficiency in operational training and combat. Through the work of PRP (Combat Crew), crews are assembled with particular emphasis on the formation and designation of potential lead crews. The performance of these crews is followed into operational training. Units are being activated in the Pacific Ocean Area to make further studies of combat requirements and combat performance.

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ACHIEVEMENT TESTS FOR THE ARMY SPECIALIZED TRAINING PROGRAM

STAFF, PERSONNEL RESEARCH SECTION

Classification and Replacement Branch The Adjutant General's Office

During 1943 and 1944 the Personnel Research Section of the Adjutant General's Office constructed over 140 achievements tests for use in the Army Specialized Training Program.* Approximately one million tests were given in a space of eighteen months to more than 150,000 trainees enrolled in approximately 200 colleges and universities. Psychologists and educators have evinced considerable interest in this wartime venture in large-scale test construction for measuring achievement at the collegiate level. This article therefore describes the purposes for which the tests were built, the circumstances which conditioned their character, the methods by which they were constructed and an evaluation of their effectiveness.

1. *Purpose of the Army Specialized Training Program (ASTP)*

The Army Specialized Training Program (ASTP) contracted with selected colleges and universities to provide training for enlisted men according to specified courses and curricula in engineering, medicine, military government and personnel psychology. The nation-wide testing program was instituted to evaluate the achievement of these students and to facilitate control of the content and quality of the instruction. Since institutions and instructors differ widely in their examining procedures and in the methods and content of their instruction, local grades would not be satisfactory. They do not provide the uniform yardstick necessary for measuring achievement of individual trainees enrolled in different training units throughout the country nor for comparing average achievement in the different units.† For these reasons, achievement tests, nation-wide in scope and objective in character, were required.

2. *The Personnel Responsible for the Achievement Testing Program*

While over-all policy and operation of the Army Specialized Training Program was a function of the Army Specialized Training Division of Army Service Forces (later the School Division under the Director of Military Training, ASF), the work of developing and administering the achievement testing program was assigned to the Personnel Research Section of the Classification and Replacement Branch of The Adjutant General's Office. This office serves the entire Army in a technical capacity and is responsible for constructing, validating and standardizing Army personnel classification tests. (See "Personnel Research Section, AGO: Development and Current Status," *Psychol. Bull.*, 1945, 42, 445-452.)

A special unit was organized within the Personnel Research Section to prepare tests for the AST program. This office constructed, published and dis-

* In March of 1944, the ASTP was drastically reduced in size. Although achievement testing has continued up to September 1945, the procedures described in this article refer primarily to the peak period from Sept. '43 through Feb. '44.

† Actually, the scores on the achievement tests were not allowed to play any part in grading at the outset of the program. Later, instructors were permitted to use these scores at their own discretion; uniform passing scores were never stipulated.

tributed all achievement tests employed in the program, and established uniform procedures for administering and scoring them and reporting on their results. It also collected and compiled operational statistics on the tests, but the responsibility for their interpretation and evaluation, and the direction of corrective measures where necessary, remained with the AST Division.

The AST test construction unit consisted of a full time staff of subject-matter specialists and psychologists trained in test construction. This staff was assisted by about 40 part-time consultants with experience in college teaching in the fields for which the tests were built.*

3. The Testing Schedule

The training program was divided into two phases. In the first or basic phase, all students were given the same courses. These corresponded to typical elementary college courses in mathematics, physics, English, history and chemistry, and were preparatory to the second or advanced phase. In the latter, the curricula were specialized into medicine, engineering, personnel psychology and foreign languages and area studies. The basic phase consisted of three terms of twelve weeks each. The advanced phase varied from one to four twelve-week terms, depending upon the nature of the specialty for which the trainee was being prepared.

For practical reasons, only final examinations were constructed by the Personnel Research Section. These were built for all the courses in the basic phase and for each course in the advanced phase which was common to several curricula. In all, tests were required for about twenty different courses. Table I shows the courses for which tests were constructed and the number of forms of each test.

The frequency of testing and of developing new tests was determined by the fact that training units were divided into cycles. *Cycle I* institutions began instruction in June 1943, *cycle II* institutions in July, and *cycle III* institutions in August.† Each term of instruction lasted three months, and new terms began immediately on the completion of those preceding. Since each month marked the end of a term for a given cycle of colleges, the achievement testing program recurred on a monthly basis. Moreover, it was necessary to produce and administer a new form of each test every three months so that no test would be repeated in any institution. The introduction of these new forms effectively checked any tendency to "teach for the examination."

4. Description of the Tests

It is obvious that only objective tests could satisfy the requirement for uniformity of scoring standards demanded by the purpose of the testing program. In addition, certain practical considerations dictated the kind of objective tests constructed. It was necessary to make the tests as nearly self-administering as possible because of the shortage of trained testing personnel in the institutions, the pressure of time, and the large number of trainees to be examined. For the same reasons, scoring procedures had to be as rapid and simple as possible.

These considerations led to the selection of a single type of objective test

* It may be of interest to professional psychologists that a number of these consultants, who had no previous training or experience in building objective tests, became highly proficient item-writers as a result of "in-service" experience on the ASTP project.

† As new institutions were brought into the program, each was assigned to one of the "cycles."

item throughout (except in the case of aural comprehension tests for foreign languages) and outweighed the advantages that might, theoretically, have been gained by varying the item type within the examination. Multiple choice items were found to be more adaptable and versatile than other types for framing questions differing widely in content and purpose. All test questions consisted of a "stem" or "problem" with four alternative responses, only one of which could be considered correct.

TABLE I

LIST OF AST ACHIEVEMENT TESTS AND NUMBER OF FORMS CONSTRUCTED
JUNE 1943-MAY 1945

(Revised Forms Not Included)

<i>ASTP Course Number</i>	<i>Descriptive Title</i>	<i>Number of Forms</i>
Chemistry 205; 61	Elementary College Chemistry, Term 1	7
Chemistry 206; 62	Elementary College Chemistry, Term 2	7
Chemistry 4A	Survey Elementary College Chemistry	2
Chemistry 401	Qualitative Analysis	2
Chemistry 402	Quantitative Analysis	2
Engineering Drawing 001; 11-61	Elementary Engineering Drawing	5
English 111; 11-61, 12- 62, 13-63	Composition and Reading Comprehension	7
Language Study 755-56, 57, 58	Chinese Aural Comprehension	1
	French Aural Comprehension	2
	German Aural Comprehension	3
	Italian Aural Comprehension	2
	Japanese Aural Comprehension	2
	Russian Aural Comprehension	3
	Spanish Aural Comprehension	2
Geography 163, Term 1; 31-71	Physical Geography	6
Geography 163, Term 2	Economic Geography	4
Geography 61	Political Geography	1
History 133	Survey American History 1492-present	3
History 133, Term 1	American History 1492-1865	2
History 133, Term 2	American History 1865-1917	2
History 133, Term 3	American History 1917-present	2
Mathematics 11	Survey of Arithmetic, High School Algebra and Plane Geometry	2
Mathematics 12	*Algebra and Trigonometry (Level 1)	2
Mathematics 406; 61	College Algebra and Trigonometry (Level 2)	6
Mathematics 407	Analytic Geometry	5
Mathematics 62	Analytic Geometry and Introduction to Calculus	3
Mathematics 408; 63	Differential and Integral Calculus	8
Mathematics 4A	Survey of College Algebra, Trigonometry, Analyt- ic Geometry, and Calculus	3
Mathematics 401	Advanced Calculus	5
Physics 11	*Mechanics (Level 1)	2

* Tests designated as level 1 are at a simpler level than those tests covering same subject matter and designated as level 2.

Physics 12	*Electricity (Level 1)	2
Physics 13	*Heat, Sound and Light (Level 1)	1
Physics 304; 61	Mechanics (Level 2)	7
Physics 305; 63	Heat, Sound, and Light (Level 2)	8
Physics 306; 62	Electricity	8
Physics 4A	Survey of Mechanics, Electricity and Heat, Sound, and Light	3
Mechanics 401	Advanced Mechanics	6
Plane Surveying 078	Principles and Methods of Surveying	2
Psychology 605	Tests and Measurements	2
Psychology 610	Statistics	2
Psychology 620	Social	1
Psychology 631	Occupations and Vocations	2

In all cases, standard machine scorable answer sheets were used. The scoring formula for all tests was simply the number of right answers; part scores or weighted scores were never used. This was done primarily to reduce the possibility of errors in scoring.†

5. How ASTP Tests Were Constructed

In order to produce tests which may be administered by relatively inexperienced persons, scored rapidly and easily, and still yield valid and reliable results when given on a large scale at different institutions, extreme care and precision must be exercised in construction. Moreover, since the use of objective tests had never before been demanded in an educational program of such scope, and were consequently foreign to many of the instructors, the staff felt a professional obligation to produce instruments which would give this form of test as fair a trial as possible.

A. Test Plan. The construction of each test began with a test plan which specified its content, form and length. It would have been desirable to plan the tests on the basis of expected outcomes of instruction, and to measure what the trainee could do with his knowledge after completing the course. However, this was not feasible since the prescribed course outlines were not always sufficiently definite concerning course objectives or expected outcomes. It was often necessary to utilize the mere subject-matter content of the syllabus as a guide in determining which areas of knowledge were to be tested. Each test plan included an estimate of the number of items to be devoted to each topic and—when possible—each course objective. In formulating test plans, the staff consulted expert opinion and made an analysis of the text books most commonly employed by the training units, the local course outlines, and local examinations. This latter information was regularly supplied by the training units to the Personnel Research Section during the first few months of the program.

* See footnote p. 555.

† As a matter of fact, studies undertaken by the Personnel Research Section showed that the correlation between "total rights" scores and scores "corrected for guessing" (i.e., rights—1/3 wrongs) on ASTP tests was extremely high. Correlation coefficients which were obtained on three separate and representative populations of AST trainees varied from .96 to .99. As might be expected from this, the odd-even reliability coefficients based on corrected and on uncorrected scores were practically identical. Moreover, these results were not affected by the nature of the test instructions with respect to guessing. The correlation between corrected and uncorrected test scores was approximately as high for tests which encouraged guessing as for tests in which guessing was discouraged.

The length of the test was conditioned by the fact that each testing period lasted only two days, and most trainees took six tests within that time. The average test could therefore not consume more than two hours. However, the average item in a social science test requires less time than the average item in a physical science or mathematics test. Moreover, the physical sciences and mathematics courses were considered by the ASTD to be the more important phases of instruction. Consequently, a time limit of approximately two hours was set for the mathematics and physical science tests, and a limit of approximately one and a half hours for the social science tests.

Since it was decided that these tests should be of the "work-limit" variety, the number of items in each was limited to that which almost all trainees could finish within the specified time limit. This was determined empirically from reports by training units, stating the number of trainees who finished each test within specified time limits, short of the maximum allowed, and also the number who failed to finish within the maximum time limit. On the basis of this evidence 50 to 65 items were found practicable for mathematics tests, 50 to 60 for advanced mechanics, 60 to 90 for the less advanced physical science courses, and 90 to 125 items for tests in English, history and geography.

All test plans were reviewed by representatives of the Army Specialized Training Division to insure conformity with the prescribed course outline.

B. *Writing and Review of Test Items.* With some exceptions,* all items were written in the Personnel Research Section, either by permanent staff members or by expert consultants. Although textbooks were used as general guides, as indicators of questions, and as references in checking accuracy, particular care was taken to avoid phrasing items in textbook terms or basing them on the particular point of view or emphasis of any given text.

All items were given a preliminary review by test technicians and consultants, working in collaboration. Each item was reviewed not only for its technical soundness but also for its significance in contributing to the measurement of the test's objectives. In addition, items were carefully checked by the test technician for conformity with the principles that govern the construction of valid multiple-choice items: the posing of a central problem, plausibility of distractors, clarity and economy of phrasing, the complete absence of irrelevant clues to the correct answer, such as length of correct alternative, grammatical construction, homogeneity of alternatives, etc.

The chief aim of these preliminary reviews was the improvement of individual items—of which approximately twice as many were constructed for each test as were required. The complete set of preliminary items were mimeographed in test form and then sent to two or three expert consultants for further review. The consultants were requested to examine each item for the following attributes: the incontestable *accuracy* of the correct answer and the equally incontestable *inaccuracy* of the other alternatives; the clarity and precision of technical language employed in stating each item; the appropriateness of the item to the course level. Moreover, each reviewer was requested to take the test and record his answers to each question. This procedure compelled the reviewer to scrutinize each item realistically and closely as a problem he himself had to solve. Faults which had otherwise escaped notice were clearly revealed by this means.

When the reviewers returned the trial tests with their comments, the criti-

* These exceptions consisted of a small number of items taken from tests built by field test construction centers, established in selected colleges and universities for the purpose of supplementing the pool of items prepared by Personnel Research Section.

cisms were collated, the poorer items weeded out, and the more useful ones revised when necessary. The final set of items for each test was keyed to a standard scoring key and rechecked both before and after printing. Prior to being printed, however, the test was once more administered to an expert consultant who had not previously taken it. The scoring of his answer sheet provided a final check. This rather elaborate procedure was introduced because experience with the very early tests showed that the combined judgment of two or more subject-matter experts was required to produce items of unequivocal accuracy.

C. Item Analyses. The preparation of the tests for the January 1944 testing period was complicated by the introduction of item analyses. This was done chiefly to improve the reliabilities of some of the tests—which at first had been unsatisfactory. In some cases, tests had been too difficult because the limitations imposed by the accelerated nature of the courses had not been fully appreciated; in other cases, the indefiniteness of course outlines had led to the inclusion of items on topics not covered by a majority of instructors. Moreover, empirical confirmation of the judgment of test-constructors and reviewers was needed concerning tests (particularly in the fields of English and history) where the material tended to be controversial and where items might reflect the bias and personal taste of the test-technician. Objectivity requires more than the intention to be objective.

In order to secure item analysis data, each test was administered in experimental form to a representative sample of training units three months before it was scheduled for national administration. At this stage, the test still contained twice as many items as were included in its final form. The items were therefore divided into two comparable series, each of which was given to half the trainees in each unit participating in the trial run. Data were analyzed to give a measure of item difficulty and to show the capacity of each item to discriminate between the 27% of the sample who made the highest total test scores and the 27% who made the lowest scores.

These results were used along with the reviewers' judgments in selecting and revising items for inclusion in the final form of the test. Copies of the experimental forms were also sent to selected instructors in ASTP units throughout the country and their comments weighed in the final assembly of the test.

D. Test Standardization. The tests prepared in this same period were also standardized by administering the final forms to representative samples of trainees one month before their release. This enabled the predetermination of percentile rank equivalents for each raw score and the preparation of conversion tables prior to the distribution of the tests for nation-wide administration. Thus it was possible for each instructor to compare the performance of his trainees with the national norms as soon as his test papers were scored.

6. Administration and Reporting of Results on AST Achievement Tests

The security of test materials was carefully guarded by regulations enforced through the military commandant of each ASTP unit. Testing conditions were made as uniform as possible through a detailed manual of directions distributed to each unit. Moreover, a field staff attached to the AST unit of the Personnel Research Section made periodic visits to the various institutions to help insure uniformity of testing conditions in all training units.

In order to compare the effectiveness of instruction offered by the various colleges and universities in terms of the achievement of their students on the tests, national test norms were required. These were based on distributions of raw test scores prepared and submitted by each institution, separately by term

and curriculum for each test administered. These distributions were combined into national frequency distributions, from which national means, standard deviations, and estimates of reliability were derived. For comparison with these national results, mean raw scores were computed for each institution by subject, term and curriculum. Since variations in mean achievement from institution to institution might be considered in part a function of variations in the ability of the men, allowance had to be made for this factor. Accordingly, distributions of standard scores made by trainees on the Army General Classification Test were submitted by each institution separately by term and curriculum. These distributions were combined and analyzed parallel with the achievement test results to yield national and local means. The results of the program were summarized each month and transmitted to the AST Division where the actual comparison and evaluation of individual units was made.

7. *Validity and Reliability of Tests*

An educational achievement test is valid to the extent that it discovers how much the student has learned in the course he has completed. The validity of national achievement tests designed to evaluate training effectiveness depends upon the uniformity of such training. If instruction differs from class to class or institution to institution an examination valid for one must necessarily be invalid for others. Uniformity is conditioned by: (a) clearly stated objectives or outcomes of instruction—well defined "expectations of behavior"; (b) syllabi which are definite, complete, and clear enough to be followed by all instructors and designed to achieve specific objectives; (c) circumstances of instruction which permit prescribed course outlines to be followed and stated objectives to be attained.

None of these conditions was consistently present throughout the AST program. In the beginning, courses were not always precisely defined either in terms of broad objectives or in the details of content. And even where these were clearly stated there were instructors who considered them as advisory rather than mandatory. In general, where content had crystallized through usage or tradition, as in mathematics and the physical sciences, there was little variation, while the courses in English, history and geography, where the controlling influence of custom has not been strong, were largely lacking in uniformity. The difficulty of matching test content to instruction in such circumstances was reflected in the instructor's comments on the tests produced during this period. It was evident that these early tests were generally unsatisfactory.

In the next period three things were done to effect a closer relation between test and instruction: (a) course outlines were revised and made more definite; (b) the item analyses referred to above were instrumental in isolating the core of essential content common to all training units; (c) preliminary forms of tests were reviewed by instructors whose comments were used in the selection of items for the final forms.

As soon as these three remedial measures had taken effect, there was a marked change in instructor evaluations. The later tests were judged to be much better matched with the courses as taught and to be more highly satisfactory measures of student achievement. It was also reported that these later tests correlated highly with student performance throughout the course.*

* These reports were confirmed by statistical analyses. One such study (made at a period when achievement test scores could not be used in determining course grades) on 600 term 1 trainees showed correlations from .53 to .64 between instructors' final

These improvements were also reflected in higher test reliabilities. Estimates of reliability of the early tests in such courses as English, geography, and chemistry had been low. After instruction had become more standardized, a better matching between test and course had been effected, there were marked improvements in reliability. The following estimates are typical of later forms of the ASTP standardized tests.

Course	No. of Items	Estimate of Reliability
Chemistry	75-90	.85-.90
English	90-115	.75-.85
Geography	125	.80-.85
History	95-100	.80-.90
Mathematics	50-65	.80-.85
Physics	70-80	.80-.90

It is interesting to note that whereas mathematics tests of 50 items consistently yielded reliability estimates of approximately .85, twice as many items were required to achieve equivalent reliability for the geography tests. The explanation again lies in the nature of the syllabi for these courses and their traditional content. For similar reasons the English tests, despite their greater length, frequently failed to yield reliabilities as high as those for the shorter tests in mathematics, physics or chemistry.

8. Conclusions

The experience gained in the ASTP testing program points toward two related conclusions.

1. National achievement testing programs are not likely to succeed unless course outlines and teaching emphases are standardized throughout all participating institutions. Such standardization can be secured only through a careful formulation of the concrete and explicit objectives of the training, and the specific minimum information and skills to be acquired in the course. Moreover, a close and continuous working relationship between the central administrative staff of such a program and the training institutions involved should be maintained in order to insure a clear and uniform interpretation of the function and content of the prescribed syllabi, as well as adjustments required in them by the practical conditions of instruction.

2. All items in such national achievement tests must pertain to a nucleus of course content selected because it is fundamental and indispensable for achieving the objectives decided upon.

grades and achievement test scores in chemistry, mathematics, physics, and history. Correlations for English and geography where the prescribed curricula permitted differing interpretation and emphasis, were consistently lower. Moreover, intercorrelations between achievement test scores were higher than intercorrelations between instructors' grades.

In this connection, it is of interest to note that the national achievement test scores were found to correlate more highly with aptitude test scores than did instructors' grades. The correlation between the aptitude test specially designed by the Personnel Research Section to select candidates for the ASTP (OCT-2, X-3) and combined achievement test scores (in chemistry, physics, and mathematics) was .74, whereas the comparable correlation with instructors' grades used as criteria was significantly lower: .45 to .55. These results parallel closely those reported for the Navy V-12 program by Crawford and Burnham in the May 1945 issue of the *Psychological Bulletin*.

PSYCHOLOGICAL TEST CONSTRUCTION AND RESEARCH IN THE BUREAU OF NAVAL PERSONNEL: DEVELOPMENT OF THE BASIC TEST BATTERY FOR ENLISTED PERSONNEL

STAFF OF THE TEST AND RESEARCH SECTION

*Training, Standards and Curriculum Division,
Bureau of Naval Personnel*

The Test and Research Section, Standards and Curriculum Division, Bureau of Naval Personnel, is responsible for developing and officially approving psychological and educational tests for use in the Navy's personnel and training programs, and for conducting research on problems of placement and training of naval personnel. The first report of this series, in the *Psychological Bulletin* for July 1945,¹ outlined the program and accomplishments of the Test and Research Section. This report deals with the development of the United States Navy Basic Test Battery for enlisted personnel, and with its use in selecting enlisted personnel for technical naval training and in classifying them for naval duties. A subsequent report will deal with the validation of the Basic Test Battery.

DEVELOPMENT OF THE BASIC TEST BATTERY

In 1942, in most of the recruit training programs, a battery of tests was used for selecting recruits for the enlisted Naval Training Schools where they were trained for such naval ratings as Electrician's Mate, Fire Controlman, Gunner's Mate, Torpedoman, Quartermaster, and Signalman. Included in the old battery of tests were a General Classification Test, and tests of mechanical aptitude, arithmetical computation, spelling, radio code, and English. Studies of these tests, made in 1942, showed that they were not effective in meeting the needs of the Navy. New tests for selection of recruits for training were required.

Early in 1943, a Test Construction Group was established in the Standards and Curriculum Section of the Bureau of Naval Personnel to develop a coordinated program of constructing and validating selection and classification tests. Later a Research Group was established.

In cooperation with personnel from a Project of the National Defense Research Committee, the staff of the Test Construction Group determined that new tests of general verbal ability, mechanical aptitude and arithmetical reasoning ability would be desirable. In view of the expansion in billets requiring the mastery of a great deal of mechanical skill and information, tests of reading and of mechanical and electrical knowledge were also considered to have potential value. At that time, tests of spelling, radio code aptitude, and English were held to be of less value for immediate inclusion in a basic battery. Late in January 1943, work was begun on the development of the following tests:

- General Classification Test, with sections on sentence completion, analogies and opposites,
- Reading Test,
- Arithmetical Reasoning Test,
- Mechanical Aptitude Test, with sections on block counting, mechanical comprehension, and surface development,

¹ Psychological Testing and Research in the Bureau of Naval Personnel: Work of the Navy's Test and Research Section. *Psychol. Bull.* 1945, **42**, 433-444.

Mechanical Knowledge Test, with sections on mechanical and electrical information and mechanical and electrical tool relationships.

By the end of March 1943 the experimental forms had been developed and administered to a selected sample of recruits in each of six Naval Training Stations. On the basis of statistical analyses, the above listed tests were revised and ready for routine administration in June 1943. Later, tests of clerical aptitude, spelling and radio code aptitude were added to the Basic Test Battery. The original five tests, commonly yielding six scores, are now available in three standard forms each, the latter three tests in two forms each. A Fleet Edition of six tests of the Basic Test Battery has also been prepared, including the General Classification Test, Arithmetical Reasoning Test, Mechanical Aptitude Test, Mechanical Knowledge Test, Electrical Knowledge Test, and Clerical Aptitude Test. Descriptions of the Basic Test Battery and the Basic Test Battery (Fleet Edition) follow.

DESCRIPTION OF BASIC TEST BATTERY

<i>Name and Description of Test</i>	<i>Number of Items²</i>		<i>Time Limit in Minutes</i>	
	<i>Part Test</i>	<i>Total Test</i>	<i>Part Test</i>	<i>Total Test</i>
GENERAL CLASSIFICATION TEST		100		33
<i>Part 1 Sentence Completion</i>	30		10	
Consists of a series of incomplete sentences, each of which is followed by five possible completing terms. The task is to select the correct term to complete the sentence.				
<i>Part 2 Opposites</i>	30		8	
Consists of a series of terms, each of which is followed by five other terms. The problem is to select from among the five terms the one which is most nearly opposite in meaning to the first term in the list.				
<i>Part 3 Analogies</i>	40		15	
Consists of a series of incomplete analogies, each of which is followed by five terms. The task is to select the correct word to complete the analogy.				
READING TEST		30		25
Consists of a series of passages about material related to Navy life, each of which is followed by a number of multiple choice responses. The task is to select for each test item the best response from five.				
ARITHMETICAL REASONING TEST		30		30
Consists of a number of problems in arithmetic. Each problem is followed by five possible answers. The task is to select the correct answer to each problem.				

² Norms on all tests and part tests have been established in terms of Navy Standard Scores where the mean is assigned a value of 50 and the standard deviation a value of 10.

<i>Name and Description of Test</i>	<i>Number of Items</i>		<i>Time Limit in Minutes</i>	
	<i>Part Test</i>	<i>Total Test</i>	<i>Part Test</i>	<i>Total Test</i>
MECHANICAL APTITUDE TEST		129		34
<i>Part 1 Block Counting</i>		45		6
Consists of a stack of blocks, some of which are lettered. The task is to count the number of blocks which touch each lettered block.				
<i>Part 2 Mechanical Comprehension</i>		44		20
Each item presents an illustration of a mechanical situation. The task is to answer correctly a question about each situation.				
<i>Part 3 Surface Development</i>		40		8
Consists of a series of flat patterns, each of which can be folded up to make a solid object, a picture of which is also shown. The task is to match certain lines in the flat pattern with the corresponding edges in the picture of the solid object.				
MECHANICAL KNOWLEDGE TEST		135		37
<i>Part 1 Tool Relationships</i>				
Electrical		25		6
Mechanical		30		6
Each item consists of one numbered picture followed by three lettered pictures in lines. Each picture shows some tool or piece of apparatus. The task is to designate the lettered picture which is most closely associated with the numbered picture at the beginning of the line. Some of the items are pictures of electrical equipment, the others of mechanical equipment.				
<i>Part 2 Information</i>				
Electrical		35		12
Mechanical		45		13
Each item consists of a question to which four answers are given. The task is to pick the correct answer for the question. Some of the items refer to mechanical information, the others to electrical information.				
The following raw scores are most commonly obtained from the test:				
a. Electrical Score (60)				
Tool Relationships plus Information				
b. Mechanical Score (75)				
Tool Relationships plus Information				
c. Tool Relationships Score (55)				
Electrical plus Mechanical				
d. Information Score (80)				
Electrical plus Mechanical				

<i>Name and Description of Test</i>	<i>Number of Items</i>		<i>Time Limit in Minutes</i>	
	<i>Part Test</i>	<i>Total Test</i>	<i>Part Test</i>	<i>Total Test</i>
CLERICAL APTITUDE TEST		213		13
<i>Part 1 Alphabetizing</i>		55		4
For each item the task is to insert one word into a group of four alphabetized words in such a position that the five words will be in alphabetical order.				
<i>Part 2 Name Checking</i>		83		5
Each item consists of a pair of names. The task is to determine whether or not the two names in each pair are identical in form, spelling and punctuation.				
<i>Part 3 Number Checking</i>		75		4
Each item consists of a pair of numbers. The task is to determine whether or not the two numbers in each pair are identical.				
SPELLING TEST		50		12
Each item consists of five words, one of which is misspelled. The task is to select the misspelled word.				
RADIO CODE TEST		150		30
Consists of a phonograph disc with International Morse Code characters recorded thereon. Three letters are presented repeatedly to the subjects. The subjects are then tested on their ability to recognize the letters when they are presented at varying rates of speed.				

USES OF THE BASIC TEST BATTERY

The primary use of the Basic Test Battery has been for selection of enlisted personnel for Navy schools. The tests are administered to all recruits in Naval Training Centers. On the basis of test scores and other factors the decision is made as to whether or not an individual should be recommended to a Naval Training School for some type of special technical training. Each test of the Basic Test Battery has demonstrated its usefulness in this selection process, but certain of the tests have proved to be more effective than others in selecting for specific types of schools. Scores on the Arithmetical Reasoning Test, for example, are significant in predicting success in Basic Engineering and Electrical schools, but are of less value than scores on the Reading Test in selecting for Radar Operator and Fire Controlmen schools. Cutting scores on one or more of the tests (scores below which success in school is considered to be unlikely) have been established for 46 types of enlisted training programs.

A second use of the Basic Test Battery is to provide a measure of the quality of enlisted men and women who enter the Navy. The test scores made by all recruits in each Naval Training Center are forwarded every two weeks to the Test and Research Section. Statistical summaries are prepared each month,

DESCRIPTION OF BASIC TEST BATTERY (FLEET EDITION)

Name and Description of Test ¹	Number of Items in Each Test	Suggested Time Limit in Minutes ²	
		For Each Test	For Each Book
BOOK ONE			55
Directions		5	
Electrical Knowledge Test	45	10	
Mechanical Knowledge Test (minus verbal items)	45	10	
General Classification Test (minus opposites items)	70	30	
BOOK TWO			60
Directions		5	
Mechanical Aptitude Test	50	20	
Arithmetical Reasoning Test	30	35	
BOOK THREE			10
Clerical Aptitude Test	250	10	

showing the mean, standard deviation, and range on each test made by recruits in each Naval Training Center and by the total recruit population. Comparisons may thus be made between the recruits at different Naval Training Centers for the same period and for different times of the year. This information may be used by a number of Navy activities in planning and evaluating their programs. Tables I and II illustrate for the General Classification Test, Form 2, the types of summaries prepared.

A third use of the Basic Test Battery is at advanced classification centers and aboard ship where test scores on one or more of the tests are taken into consideration in the assignment of men to billets or stations. For example, test scores of 55 or more on the General Classification Test are considered desirable for Gun Captains. All candidates for submarine service are required to have a score of 50 or above on the General Classification Test.

TABLE I

NAVY STANDARD SCORES ON BASIC TEST BATTERY (General Classification Test, Form 2)
MADE BY RECRUITS AT NAVAL TRAINING CENTERS FOR THE PERIOD JANUARY 1944
THROUGH FEBRUARY 1945

Station	N	M	σ	Range
A	84,107	49.13	10.49	21-76
B	108,796	51.45	9.87	21-76
C	287,923	51.21	11.15	21-76
D	178,328	50.56	10.05	21-76
E	117,730	48.70	10.68	21-76
All Stations	776,884	50.49	10.64	21-76

¹ Items for each test are of the same type as for corresponding test of Basic Test Battery.

² Time limits for the separate tests in Book One and Two are suggested time limits only. The subjects are timed on each book as a whole.

TABLE II

TREND IN NAVY STANDARD SCORES ON BASIC TEST BATTERY (General Classification Test, Form 2) MADE BY RECRUITS AT ALL NAVAL TRAINING CENTERS BY MONTHS
JANUARY 1944 THROUGH FEBRUARY 1945

Month	N	M	σ	Range
1944				
January	88,320	48.22	10.59	21-76
February	62,298	48.99	10.37	21-76
March	84,426	49.48	10.65	21-76
April	81,898	50.07	10.55	21-76
May	96,161	51.00	10.64	21-76
June	68,741	53.38	10.31	21-76
July	47,335	54.42	10.52	21-76
August	33,932	52.68	10.44	22-76
September	52,109	51.26	10.56	21-76
October	35,105	50.32	10.35	21-76
November	28,302	49.66	10.10	21-76
December	33,139	49.01	10.13	21-75
1945				
January	31,997	49.34	10.21	22-76
February	33,121	49.92	10.53	21-76

ANALYSES OF THE BASIC TEST BATTERY

The Basic Test Battery has been subjected to item analyses, time limit studies, determination of reliabilities, development of norms, validity studies, inter-correlation studies, and factor analyses. The results of some of these studies are summarized below.

*Item Analyses.*⁵ The sample populations for the item analyses of the preliminary forms were selected to be representative of the total recruit population. Item analyses were made by computing for each item of a test, the mean total score on the test made by persons who selected choice one, the mean total score made by persons who selected choice two, the mean total score made by persons who selected choice three, and so on. In addition the mean total score made by persons who omitted the item was calculated. The value of each item was determined by comparing the mean total score made by persons who selected the correct response with the mean total score made by persons who selected each of the wrong responses, or who omitted the item altogether. A satisfactory item was considered to be one which showed:

- a reasonable number of omissions,
- a mean score made by those selecting the correct response which was higher than the total mean score, and
- a set of efficient distracting responses.

On the basis of the item analyses, each of the items was rejected, revised, or retained as originally stated, and Form 1 of the battery was prepared for use. On Forms 2 and 3 of all tests, and on the Fleet Edition of the Basic Test Battery, with the exception of the Clerical Aptitude Test, item analyses were made by comparing the upper and lower-quarters.

⁵ This section of the report deals with analyses of the General Classification Test, Reading Test, Arithmetical Reasoning Test, Mechanical Aptitude Test, and Mechanical Knowledge Test.

*Time Limit Study.*⁶ For the determination of the optimum time limits, the preliminary form of each test was administered to a carefully selected sample population of recruits in a Naval Training Station. Three experimental time limits were used for each test or part test: a long time limit which was thought to be sufficient to permit nearly all recruits to attempt every item, and two shorter time limits. The procedure was to call "Mark" at the end of the briefest

TABLE III

ESTIMATED RELIABILITY COEFFICIENTS OF BASIC TEST BATTERY BASED UPON DATA OBTAINED FROM ROUTINE ADMINISTRATION TO RECRUITS

Name of Test	Estimated Reliability Coefficients Based on Data for Single Form*			Reliability Coefficients Based on Data for Two Forms of the Same Test	
	Form 1	Form 2	Form 3	Forms 1 & 2	Forms 2 & 3
General Classification Test	.91 (200)**	.95 (200)	.96 (250)	.90 (450)	.93 (500)
Reading Test	.82 (200)	.89 (200)	.87 (250)	.72 (450)	.81 (500)
Arithmetical Reasoning Test	.86 (200)	.88 (200)	.90 (250)	.82 (450)	.86 (500)
Mechanical Aptitude Test	.95 (200)	.95 (200)	.95 (200)	.88 (250)	.87 (500)
Mechanical Knowledge Test (Mechanical Score)	.90 (200)	.92 (200)	.91 (200)	.87 (250)	.86 (500)
Mechanical Knowledge Test (Electrical Score)	.84 (200)	.89 (200)	.82 (200)	.78 (250)	.83 (500)
Clerical Aptitude Test	.91 (780)†	.95 (400)†		.86 (400)	
Spelling Test	.85 (780)†	.91 (400)†		.73 (400)	
Radio Code Test	.88 (470)††				

* Spearman-Brown Formula used to estimate reliability from odd-even test correlations except as noted.

** Figures in parentheses represent the number of cases in the sample used.

† Reliability coefficients computed by Kuder-Richardson Formula #21.

†† Spearman-Brown Formula used to estimate reliability from correlation between Part I and Part II.

time limit and have recruits mark their papers to indicate progress. Then further time was allowed, and again the subjects were asked to stop and mark their papers. The third limit was arrived at by another extension of time. Scores on the first and second time limits were correlated with the maximal score obtained after the longest time limit was reached. The proportion of recruits completing each test or part test within the various time limits was also determined. Final time limits for each test were determined on the basis of the following criteria:

- a. the time limit with a high correlation of scores with those scores received under the maximum time limits,
- b. a time limit at which approximately fifty per cent of the subjects attempted all of the items,
- c. a time limit for which there was a well-balanced distribution of scores.

Test Reliabilities. Test reliabilities for Forms 1, 2, and 3 of the original five

⁶ This section refers to the original five tests. Similar studies have been done for Form 1 of the Clerical Aptitude Test, Spelling Test, and Radio Code Test.

tests have been determined by the split-half method. Total scores for odd-numbered items and for even-numbered items on a test were correlated and the resulting coefficients of correlation corrected by the Spearman-Brown Prophecy Formula. Reliabilities for these tests, for the Clerical Aptitude Test and Spelling Test, and for all tests of the Fleet Edition have also been calculated by the Kuder-Richardson Formula #21. In each of the samples used in determining test reliability, the mean and standard deviation of the distribution approximated the corresponding figure for the national recruit population at the time. The reliabilities of the tests are shown in Tables III and IV.

TABLE IV

DATA ON TEST RELIABILITY OF THE BASIC TEST BATTERY (FLEET EDITION) BASED ON RECRUIT PERFORMANCE ON TESTS

Name of Test	Estimated Reliability	Correlation Coefficients between
	Coefficients Basic Test Battery (Fleet Edition) Form 1*	Tests of Form 1 of Basic Test Battery (Fleet Edition) and Com- parable Tests from Form 1 of Basic Test Battery
General Classification Test	.90 (500)**	.84 (500)
Arithmetical Reasoning Test	.77 (500)	.86 (500)
Mechanical Aptitude Test	.88 (500)	.74 (500)
Mechanical Knowledge Test	.87 (500)	.64 (500)
Electrical Knowledge Test	.79 (500)	.66 (500)
Clerical Aptitude Test	.96 (400)	.78 (400)

* Reliability coefficients computed by Kuder-Richardson Formula #21.

** Figures in parentheses represent number of cases in sample used.

Development of Norms. The norms on Form 1 of each of the original five tests were obtained from the scores made by a sample of the total recruit population. The sample from each Naval Training Station was chosen so as to be representative of its intake and proportional to its contribution to the total recruit intake. Norms for subsequent forms have been developed in a similar manner. In order that scores on all the tests might be comparable, the norms for all forms of all Navy tests have been established in terms of Navy Standard Scores with the mean on the test assigned a Navy Standard Score value of 50 and the standard deviation a value of 10.

Test Scores in Relation to Age and Educational Level. Table V shows the correlation coefficients between test scores and age and between test scores and highest school grade completed for a national sample of recruits in April 1944. It is interesting to note that the correlations between test scores and educational level are moderately high as might be expected, while, with two exceptions, the correlations between test scores and age are close to zero. It appears from the data in this table that as one gets older he may acquire a background of information relative to mechanical and electrical tools and processes more readily than he may improve in ability to read or to solve problems calling for arithmetical reasoning, or in mechanical or clerical aptitude.

Intercorrelations and Factor Analyses. Table VI presents the results of two intercorrelation studies. Data for the first of these studies, on Form 1, were obtained from a representative sample population of 500 recruits from all Naval Training Stations from July to October 1943. Data for the second study, on

Form 2, were collected from a sample of recruits from all Naval Training Stations in April 1944. The degree to which each sample studied was representative of the corresponding national recruit population is indicated by the following comparisons on the General Classification Test:

	General Classification Test		
	M	σ	N
<i>Form 1</i>			
Sample Population	47.50	10.21	500
Total Recruit Population	48.10	10.88	25,000
<i>Form 2</i>			
Sample Population	50.13	10.53	933
Total Recruit Population	50.07	10.55	81,898

Both the intercorrelation studies and the factor analyses reveal that all the tests have some elements in common. The intercorrelations, as can be noted in Table VI, range from .33 between the Mechanical Knowledge Test (Mechanical

TABLE V

CORRELATION COEFFICIENTS BETWEEN TEST SCORES AND AGE AND TEST SCORES AND SCHOOL GRADE COMPLETED, FOR BASIC TEST BATTERY: ALL TESTS

Test	Correlation Coefficients			
	Test Score with Age	Test Score with Highest School Grade Completed	M	σ
	(N = 906)	(N = 908)		
General Classification Test	.10	.65	50.1	10.6
Reading Test	.02	.58	51.0	11.7
Arithmetical Reasoning Test	.12	.57	50.0	11.6
Mechanical Aptitude Test	-.02	.52	50.4	10.3
Mechanical Knowledge Test (Mechanical Score)	.30	.39	52.1	11.2
Mechanical Knowledge Test (Electrical Score)	.19	.56	50.8	10.4
Clerical Aptitude Test	-.09	.65	50.3	9.2
Spelling Test	.06	.53	50.1	9.9
Radio Code Test	.05	.41	52.3	10.9
Age	—	-.02	26.1	6.7
Highest School Grade Completed	-.02	—	10.2	2.3

Score), Form 2 and the Spelling Test, Form 1, to .85 between Reading Test, Form 2, and General Classification Test, Form 2. The lowest group of intercorrelations are between the Mechanical Knowledge Test (Mechanical Score) on the one hand, and the Clerical Aptitude Test, Spelling Test, and Radio Code Test on the other.

Two factor analyses have been done on the tests of the Basic Test Battery, the first on the tests of Form 1, the second on Form 2 of the original tests plus Form 1 of Clerical Aptitude Test, Spelling Test, and Radio Code Test. The results of the second analysis will be summarized briefly.

Four factors were found. Factor A is a general intellectual factor, Factor B a specialized mechanical information factor, and Factors C and D are not clearly defined. Other

TABLE VI

INTERCORRELATIONS AMONG TESTS OF THE BASIC TEST BATTERY BASED ON DATA OBTAINED FROM ROUTINE ADMINISTRATION TO RECRUITS*

Test	Variable	B	C	D	E	F	G	H	I	Navy Standard Score M	σ
General Classification											
Form 1	A	.81	.69	.60	.49	.53				47.50	10.21
Form 2		.85	.79	.69	.57	.73	.68	.68	.61	50.13	10.53
Reading											
Form 1	B		.69	.56	.46	.51				45.00	10.00
Form 2			.77	.67	.53	.68	.64	.63	.51	51.15	11.61
Arithmetical Reasoning											
Form 1	C			.61	.41	.47				45.00	9.95
Form 2				.69	.53	.68	.64	.58	.51	49.99	11.62
Mechanical Aptitude											
Form 1	D				.55	.53				48.00	10.31
Form 2					.61	.69	.65	.48	.49	50.51	10.28
Mechanical Knowledge (Mechanical)											
Form 1	E					.78				48.00	10.55
Form 2						.75	.36	.33	.34	52.32	11.19
Mechanical Knowledge (Electrical)											
Form 1	F									48.00	9.47
Form 2							.55	.54	.45	50.89	10.43
Clerical Aptitude											
Form 1	G							.66	.53	50.24	9.08
Spelling											
Form 1	H								.39	50.12	9.89
Radio Code											
Form 1	I									52.38	10.95

* The data in light face are based on a sample of 500 persons for whom scores were obtained on Form 1 of General Classification Test, Reading Test, Arithmetical Reasoning Test, Mechanical Aptitude Test, Mechanical Knowledge Test (Mechanical Score), and Mechanical Knowledge Test (Electrical Score). The data in bold face are based on a sample of 933 persons for whom scores were obtained on Form 2 of the tests listed above plus Form 1 of Clerical Aptitude, Spelling, and Radio Code Tests.

factors may be measured by the tests, but with the restricted number of the tests in the battery they did not show up in this analysis.

The loadings of all tests on Factor A were .57 or higher. Its general structure is best

indicated by the fact that the General Classification Test, Reading Test, and Arithmetical Reasoning Test have very high loadings (.86 or higher) on Factor A and zero loadings (.11 or less) on Factors B, C, and D. In other words it appears that Factor A is a general intellectual factor. These high loadings are, in part, accounted for by the fact that Factor A is highly correlated with Factors B, C, and D, although the latter appear to be relatively independent of one another.

Factor B appears to be a specialized mechanical information factor. Both the Mechanical Knowledge Test (Mechanical Score) and the Mechanical Knowledge Test (Electrical Score) have high loadings (.50 or better) on Factor B and zero loadings (.11 or less) on Factors C and D.

Factors C and D are not clearly defined. Factor C might best be described by noting that the Mechanical Aptitude Test and the Radio Code Test have moderate loadings (.30 to .33) on it and zero loadings on Factors B and D. Parts One and Three (*Block Counting* and *Surface Development*) of the Mechanical Aptitude Test involve the ability to perceive visual relationships, while the Radio Code Test involves the ability to perceive auditory relationships. In terms of this evidence it might seem plausible to call Factor C "Speed in perceiving visual and auditory relationships." The Spelling Test is the only test having moderate loadings on Factor D and zero loadings on Factors B and C. The Clerical Aptitude Test has loadings of .30 on both Factors C and D.

From studies of validity of the tests of the Basic Test Battery for predicting the success of men in Naval Training Schools it is apparent that each test of the battery is of value in predicting success in some schools. For example, the Mechanical Knowledge Test (Electrical Score) is effective in selecting men for special training as Motor Machinist's Mate, the General Classification Test for selection for Signal Schools, the Mechanical Aptitude Test and Mechanical Knowledge Test (Mechanical Score) together for identifying those persons who can be most effectively trained as Machinist's Mates.

SUMMARY

The development of the Basic Test Battery has been among the major projects of the test development and personnel research program of the Bureau of Naval Personnel since early in 1943. Tests of the Basic Test Battery, Form 1, 2 or 3, have been administered to approximately two million recruits and other enlisted personnel. On the basis of comprehensive study of the tests of the battery a revision is in process. The first form of the Fleet Edition of the battery has been used with approximately 125,000 persons to provide data for use in classifying men for various types of duties aboard ship. Numerous requests have been received for copies of the Fleet Edition and additional forms are in process of preparation.

Since the first routine use of the tests, data have been regularly collected showing the relationship between test scores and various measures of success in enlisted training programs. More recently, studies have been instituted on the effectiveness of test scores in predicting success in naval duties aboard ship. Results of these studies on validity of the Basic Test Battery for selection and classification will be presented in a forthcoming article.

PSYCHOLOGY AND THE WAR: NOTES

Central Register for Reports in Military Psychology. The Military Division of the APA is setting up a central register where members who wish to cooperate may file lists of unpublished manuscripts and reports in the field of military psychology, together with any special fields of experience. Such lists should be sent to the Secretary, *Commander William A. Hunt H(S) USNR, Neuropsychiatric Branch, Bureau of Medicine and Surgery, Navy Department, Washington 25, D.C.* It is requested that a list rather than actual manuscripts be sent to the Secretary, as the Division will not assume the responsibility for circulating unpublished material. Once the Military Division organizes this material, the Office of Psychological Personnel will serve as a permanent repository and make the file available for consultation. Anyone interested in specific items can then contact the psychologist concerned. While much has been published on the part psychology has played in the present war, many unpublished papers, official reports, etc. are not available in print and much that has not been put in reports, is locked in the personal memories of military psychologists. This new file will enable research workers and historians to consult material beyond that available in the literature.

Predoctoral Fellowships in the Natural Sciences. The National Research Council is ready to receive nominations and applications for the predoctoral fellowships in the natural (i.e. mathematical, physical, and biological) sciences which it administers under a Rockefeller Foundation grant. These fellowships are intended to assist young men and women, whose graduate study has been prevented or interrupted by the war, to complete work for the doctorate. It is hoped that they will accelerate the recovery of that scientific vigor and competence which is so seriously threatened by the loss of two graduate school generations of scientifically trained men and women. This program will be administered by a Committee on Predoctoral Fellowships of the NRC whose members are Henry A. Barton, Charles W. Bray, Detlev W. Bronk, Luther P. Eisenhart, Ross G. Harrison (Chairman NRC, ex officio), W. A. Noyes, Jr., and John T. Tate, chairman; Enid Hannaford, secretary.

The annual stipend will be \$1200.00 for single persons and \$1800.00 for married men. In general each recipient is expected to spend eleven months per year on academic work. An additional allowance up to \$500.00 per year will be made for tuition and fees. Fellowships granted to those eligible for educational support under the "G.I. Bill of Rights" will be at such stipends as to bring the total income from both up to that which would be received at the above rates. Before entering his graduate studies, each fellow will submit to the Committee on Predoctoral Fellowships a schedule, approved by his graduate school dean, for the completion of the work for the doctorate. On approval by the committee, this schedule will be the informal agreement upon which stipend payments will be based. At the university's discretion, the fellowship stipend may be supplemented by university grants. All such supplementary income should be recorded with the committee. The progress of fellows is subject to periodic review by the committee which reserves the right to cancel fellowships when satisfactory progress is not being maintained.

Prospective candidates for these fellowships should apply at once even though they may be unable to undertake their graduate study in the immediate future. Information concerning these fellowships and Nomination-Application blanks are being mailed out widely to graduate schools and wartime research laboratories. They may also be obtained by writing directly to the *Secretary, Committee on Predoctoral Fellowships, National Research Council, 2101 Constitution Avenue, Washington 25, D.C.*

BOOK REVIEWS

HADAMARD, JACQUES. *The psychology of invention in the mathematical field*. Princeton: Princeton Univ. Press, 1945. Pp. xiii + 143.

Almost anyone who can write can write a book on psychology, especially in a field like invention, and Jacques Hadamard, distinguished French mathematician, professor emeritus of the *College de France* and the *École Polytechnique*, and recently visiting professor at Columbia, has the precedent of Poincaré, whom he follows in his conception of the problem and in his method. But in writing this small book Hadamard is not merely indulging a recently acquired avocational interest, like a retired admiral trying his hand at chicken farming. He has written and lectured on this topic previously, and has spent many scholarly hours reading and thinking about mathematical discoveries and debating the controversial issues with other mathematicians. The result is an enjoyable, minor essay on invention, from the inside, which anyone with an interest in this field ought to read.

The material from which Hadamard's essay is composed is introspective, in the tradition of Poincaré, consisting of reports from mathematicians who have significant inventions or discoveries to their credit. In considering the problem of whose creative processes are worthy of inquiry he criticizes an earlier investigator for trifling with "alleged mathematicians whose names are now completely unknown" and even states that the "laws of tense thought may be and seem to be very different from those of usual and common ideation, which is the only frequent one among ordinary people." These reports from the author and other extraordinary people yield an acquaintance with their work methods and at least one fairly definite generalization, namely, that most of these mathematicians are not aware of imagery of words, at least not in the initial "combinatory play," as Professor Einstein calls it in his letter to the author. Instead they report kinetic imagery and imagery of points, masses and schemes, this imagery functioning, as Poincaré phrased it, "in order that useful hookings, once obtained, may not get lost."

Such testimonials from big-name mathematicians give the reader the feeling that he is coming closer to the process of invention, and those concerned with imagery are valid enough, almost by definition. But the introspective method is a notoriously misleading one for attacking problems such as the function of images, sources of ideas and necessary conditions for thought, or questions like No. 7 in the questionnaire printed as Appendix I: "What, in your estimation, is the role played by chance or inspiration in mathematical discoveries? Is this role always as great as it appears to be?" It is in answering queries of this sort that one's intellectual predispositions are practically insurmountable. No mathematician, at least none who has lived in our culture longer than Joel Kupperman, approaches this question with an open mind.

Among psychologists Hadamard will be criticized for his treatment of the unconscious and the motivation of invention. In his chapter on unconsciousness he draws attention to automatic writing, sudden and unexplained illuminations, shifts in the focus of attention and other mysterious subjective phenomena, then, in the next chapter, asserts that it is this unconscious, whose existence he has established, which has the critical function of sorting out the useful combinations of ideas from the useless. For "consciousness," he says, in a sentence which is either a slip of an otherwise careful pen or an illustration of the extreme ambiguity of the word, "only knows of the right ones." Hadamard's reluctance to treat the more intimate psychological events on a naturalistic plane is epitomized in his curious distinction, on page 20, between two kinds of chance:

psychological chance, consisting of fortuitous mental processes acting inside unconsciousness, and external hazards.

In Hadamard's analysis of invention a major part is played by the "sense of beauty," meaning beauty of a scientific or intellectual sort. This concept, though hard to define, is explicitly defended and is, in fact, offered as the guide to the unconscious in its choice of ideas and as the drive for discovery. "It seldom happens that important mathematical researches are *directly* undertaken in view of a given practical use: they are inspired by the desire which is the common motive of every scientific work, the desire to know and understand." The argument for this one-sided explanation, in the final chapter on *The General Direction of Research*, is a *non sequitur*: Since most mathematical research is not applied research, it must be driven by a sense of beauty. Desires for attracting attention, doing something different, founding a school, professional advancement, and other less noble impulses, which Hadamard will admit may motivate literary and artistic production, do not achieve results in mathematics, certainly not good results.

It seems to the reviewer that Hadamard has carried the testimonial method of research about as far as it will go. He has collected a fascinating variety of continental lore and anecdotes about scientific invention. He is aware of the importance of individual differences, and even has a chapter on *Different Kinds of Mathematical Minds*. Working with this material he has pondered carefully, from an inside position, over the important aspects of the problem. Although some may quarrel with his final stand at several points, it is hardly fair to criticize the lack of objectivity in a work of this kind when there is little objective evidence available on the problem in the form in which he has set it up.

DONALD M. JOHNSON.

University of Illinois.

FARBER, MARVIN. *The foundation of phenomenology*. Cambridge, Mass.: Harvard Univ. Press, 1943. Pp. xi + 585.

The content of this book is clearly indicated by its sub-title: *Edmund Husserl and the Quest for a Rigorous Science of Philosophy*. It is the third in a planned series of publications of the International Phenomenological Society. The author, who studied under Husserl in the course of his graduate work in Germany, gives a comprehensive, critical survey of the latter's thought. A large part of the book is devoted to Husserl's most famous work, the *Logische Untersuchungen*. This has been done, the author tells us in his preface, in fulfillment of a promise made to Husserl.

Husserl is coming to be widely recognized as a highly original thinker who initiated a new descriptive method in philosophy which opens up extensive possibilities. Just how extensive the possibilities of phenomenology are it remains for the application and the criticism of Husserl's followers to show. Professor Farber takes up the products of his thought mainly in chronological order. He distinguishes several stages in Husserl's development as a thinker. These stages, he finds, may be reduced to three periods, characterized as (1) psychologism, (2) simple descriptive phenomenology, (3) transcendental phenomenology. The first period is one in which Husserl tries to establish a psychological foundation for logic and mathematics. In turning against psychologism later, Husserl did not, of course, turn against psychology. Throughout his career he held a

very favorable attitude toward psychology and did much to forward its development. The second period of Husserl's thought is characterized by the attempt to develop a method free from the assumptions of psychology and metaphysics, and thus to make phenomenology, now established as an autonomous discipline, the most rigorous of the sciences. This last claim is supported by the belief that phenomenology is founded upon pure experience, free from presuppositions. In the third period Husserl maintains that the proper approach to philosophy is through what he calls the phenomenological reduction, the suppression of all assumptions. Phenomenology is now defined as the science of transcendental consciousness, and as such it differs widely in method from psychology.

To the psychologist, Professor Farber's book is interesting primarily from a historical and systematic point of view. Husserl was a pupil of Brentano, and his development of the act psychology of his teacher had an important influence upon some of the leading psychologists of his day—notably Stumpf, to whom the *Logische Untersuchungen* is dedicated, and Külpe. His phenomenology helped, more or less directly, to pave the way for the appearance of *Gestalt* psychology. Husserl came to make a sharp distinction between phenomenology and descriptive psychology, which in his early thought he had considered identical. His emphasis upon phenomena, however, had its effect upon the thinking of contemporary psychologists at both stages.

Professor Farber remarks that "Husserl has been one of the most misunderstood men in the history of philosophy" (p. 544). This is doubtless due in no small measure to the originality of this thought. Professor Farber's book should go a long way toward clearing up misunderstandings on the part of contemporary students. The author wisely points out that "an extensive literature is necessary for the assimilation of Husserl's contributions . . ." (p. 5). Other works are projected or in preparation. The volume under consideration is timely for the psychologist as well as for the philosopher. In spite of the practical emphases imposed by the times, there are evidences that psychologists are carefully examining the presuppositions of their science and its relation to other intellectual undertakings. When such questions arise the study of a discipline which consistently endeavors to free itself from all presuppositions cannot fail to be enlightening.

The author's style is clear, but by no means simple, as, of course, it cannot be, given the subject with which he deals. Admirable too are the cooperative spirit in which he approaches broader problems and his open-mindedness. Although Professor Farber says that Husserl remains one of the great influences upon his own development, he does not by any means follow his master in strict "orthodoxy." He is keenly critical of a number of points of view which developed in Husserl's transcendental idealism. He points out, for example, that Husserl sometimes fails to "acknowledge the assumptive nature of the general field of subjectivity" (p. 541). He then goes on to remark, "Subjectivity cannot be said to have a being of its own, independently of the natural conditions of existence. It, too, has a locus in the physical world, if by being *actual existence* in the natural sense is meant. It can—and must for philosophical purposes—however, be *treated* as autonomous, as disengaged from its natural setting" (p. 542). Such an interpretation of subjectivity cannot but recommend the author favorably to the majority of contemporary psychologists.

JOHN T. METCALF.

University of Vermont.

SEWNY, VAHAN D. *The social theory of James Mark Baldwin*. New York: King's Crown Press, 1945. Pp. vi+93.

As James Mark Baldwin is considered as one of the American founders of both psychology and sociology, his formulations in the field of social phenomena deserve at least a general review. To Baldwin, the study of the self is basic to the study of societal processes, and the self is best to be studied as it develops in children from a simple discrimination between persons and inanimate objects to an appreciation that others have the same sorts of experiences as the person himself. Social imitation, as an innate impulse, lies at the root of all socialization, with "invention" as a concomitant variant response to learned social behavior. Play aids socialization by providing for "a sort of artificial recapitulation of the . . . exertions of race progress." The main stages in social organization are (1) the instinctive, (2) the spontaneously learned, and (3) the reflective, where behavior is guided by "intelligent judgment." As society passes through these stages, it becomes less dependent on inherited and more on learned social behavior patterns. To Baldwin, the social self is essentially an *ethical* self, with the "average man" defined as "a person who learns to judge by the judgments of society." The school, the state and the church are institutions requisite in every society, to serve its "cultural," "regulative," and "sentimental" interests. Evolution in human society is based on accommodation to environment and social transmission of the resulting learned methods. Knowledge passes through the *prelogical* (theological) and the *logical* (scientific) to the *hyper-logical* (aesthetic) stage.

From our present day point of view, Baldwin's approach may best be characterized as social-evolutionistic, Hegelian-idealistic, and verbal-theoristic. At best many of his formulations are capable of suggesting hypotheses which are potentially precisely formulable. At worst, his "verbal" approach is confusing and principally lacking in those precise formulations which ultimately are the only adequate basis for science in any field. Historically, Baldwin's approach must be evaluated coordinate with Cooley's as an important and valuable contribution to the foundation of sociology and social psychology as empirical sciences.

R. B. AMMONS.

State University of Iowa.

RICHMOND, WINIFRED V. *Making the most of your personality*. New York: Farrar and Rinehart, 1942. Pp. vi+247.

This book was written by a psychologist who assures her readers that it is a book for adolescents which contains what young people themselves want to know, a claim based upon the submission of the manuscript to 28 high school boys and girls for criticisms and suggestions.

There is no legitimate objection to the book's contents: in fact, everything said is so obvious and has been repeated so often that the book is not justified on informational grounds. Its chance to become a real contribution lay in a fresh approach, cleverly devised to attract and hold the elusive attention of the adolescent. In this, she both succeeds and fails: when she is concrete and specific, she succeeds; when she generalizes and preaches, she fails. In the sections where there is a real attempt to elaborate the theme implied by the title (Chapters VI, VII, VIII, IX), the book provides interesting and purposeful reading, with a novel game-like flavor.

One suspects another veiled attempt at sex education camouflaged from the

unsuspecting by a popular and misleading title. The writer's confidential approach gives the impression that she is letting the readers in on a secret and will tell all, which, in fact, she does. The section on *The Sex Side of Life* is so frank and detailed compared with the other chapters that if the book were to be made available to adolescents in general, the pages of this chapter would probably become worn with use, while the other chapters remained untouched and unseen.

Inconsistency in the use of terms is evident throughout, particularly with regard to the word "childish." "Childish" exuberance is complimentary, but it is also "childish" to be selfish, impatient, to gossip, to be a homosexual, to have a temper tantrum, to be a sex pervert, or to behave in certain ways when senile. The author seems aware in this repetitious usage that the label of "childish" is effective in stigmatizing anything for an adolescent, but its effectiveness is lost through indiscriminate use.

The concluding chapter, *All Sorts of People*, is irrelevant and redundant. It adds the final touch to the book's message which seems to be that life is complex, particularly in its emotional aspects, and that any teen-ager who will be able to unravel its maze of complexes, yearnings, suspicions and dreams, will be fortunate (and rare) indeed.

The book describes the adolescent for the adolescent's parent better than for the adolescent himself. Many of the admonitions and emphases depend upon an experiential background not possessed by teen age children. Adolescent psychology is presented more as a threat to personality than as a transition stage in the growth process. The book's appeal could have been increased by a point of view which harbored a healthy respect for personality hazards, but which also got across to the boy or girl the many advantages and privileges of adolescence.

ELIZABETH MECHEM FULLER.

University of Minnesota.

ROBACK, A. A. *A Dictionary of International Slurs (Ethnophaulisms)*. Cambridge, Mass.: Sci-Art Publishers, 1944. Pp. 394.

Dr. Roback has begun the intriguing task of a systematic survey of name-calling between the nations. In a 100 page literary essay, he then rushes into an interpretation of "ethnic prejudice" and comes out with a moving appeal for reform and enlightenment. Between the nasty slur and the aspiring slogan, he draws but one strong thread, the persistence of anti-semitism. He has utilized his original researches into Jewish literature and folklore.

He lists slur expressions and derogatory proverbs, about 3000 in all; these are organized sometimes according to the language source and to the group criticized, and sometimes merely alphabetically. His sources are 12 English compilations of slang and cant, 82 foreign dictionaries, and 30 books cataloguing the proverbs of nations and folks. The erudition is almost flagrant; yet several cases of historic-linguistic correlation through which we come to understand the rise of particular epithets serve to point up possibilities in this philological approach to prejudice and folklore. Naturally the English sections are far more complete; yet even in the foreign jargon data listed we gain insight into the particular attitudes within special group interactions: rivalries, recriminative insults (e.g. blame for the spread of syphilis), scapegoating against a group (as against the Negroes) or within a nation (such as one class of Jew against another), and forced tolerance (legislation against slandering groups).

We find historic roots for the Nazi paranoiac outbreak in a 17th century

German proverb expressing a sense of oppressed isolationism (213); and there are corresponding warnings against the Germans in long-standing proverbs from Austrians, Czechs, Danes, Hungarians, Italians, Poles, Russians, Swedes, and Swiss, e.g., "When a snake warms himself on ice, a German will begin to wish well a Czeck;" and, "Wherever Germans are, it is unhealthy for Italians" (168).

The proverbs are generally a safer source than slurs, since contexts and usage are less ambiguous, and, as witticisms, they may represent a more consolidated antagonism and argument. Philologically, the slurs are richer in their subtle reflections of feeling tones and of language process. However, the task is enormous, full of the most serious obstacles in interpreting semantic and emotive significances and sources. Surely one man of one culture will be unable to do justice to the colloquialism of 50 other groups. The inevitable consequence here is a very uneven treatment of his raw data; they remain largely superficial and unanalyzed. Though dealing so directly with national differences and stereotypes there is no mention of Klineberg or Lippman! The name of psychoanalysis is called in vain (248); for the "id" character of prejudice (249) is never demonstrated nor its primary processes applied, and the superiority of "ego training" (342) over education is never explained. Dr. Roback's essay is "psychologicistic" and literary but only incipiently analytic.

JOEL SHOR.

New School for Social Research.

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NOTES AND NEWS

JOHN J. B. MORGAN, professor of psychology, Northwestern University, died August 16, at the age of fifty-six years. Dr. Morgan received his Ph.D. from Columbia in 1916 and was an instructor in psychology, Princeton University, in 1917. During World War I, he was chief psychological examiner at Camp Hancock, with the rank of Captain. He served as assistant professor of psychology, University of Minnesota, 1919-20 and as assistant professor and director of the psychological clinic, the State University of Iowa, from 1921 to 1924. In 1925 he became assistant professor at Northwestern, in 1927 associate professor, and in 1933 professor of psychology. Dr. Morgan was a widely recognized authority on child psychology and on abnormal psychology and was the author of many articles and texts. He became a member of the Association in 1916.

WINIFRED V. RICHMOND, psychologist, State Department of Public Welfare, Santa Fe, New Mexico, died on July 5, 1945.

The honorary doctorate of laws was conferred June 23 by the University of California on LEWIS M. TERMAN of Stanford University. On June 28, at Harvard University, his son, FREDERICK E. TERMAN, director of the radio research laboratory at Stanford, was awarded the honorary doctorate of science.

GEORGE R. BACH, formerly instructor in psychology at Western Reserve University, has been appointed professor of psychology at Kent (Ohio) State University.

J. S. A. BOIS, Lieut. Colonel in charge of the Research and Information Section, Adjutant General's Branch, N.D.H.Q. (Ottawa, Ont.), has been released from the Army and has taken the position of senior staff psychologist with Stevenson and Kellogg, Ltd., Management Engineers in Montreal.

CHARLES W. BRAY and HADLEY CANTRIL, associate professors of psychology at Princeton University, have been advanced to professorships, and LEO P. CRESPI, instructor in psychology, has been advanced to an assistant professorship.

WALLACE CRAIG, research fellow in psychology at Harvard University has received a grant of \$1,250 from the Penrose Fund of the American Philosophical Society for a study of "The space system of the perceiving self."

MAJOR KARL M. DALLENBACH, of the U. S. Army, on leave from the professorship of psychology at Cornell University, will become Susan Linn Sage professor of psychology on his return from military service. This professorship was established in 1885 as a gift from Henry W. Sage.

The following promotions were announced recently by the University of Pittsburgh: to associate professorships in psychology, ALFRED G. DIETZE and WILLIAM R. GROVE, the latter to be in charge of the psychological clinic and veterans' counseling service; and to an instructorship in psychology, ERMA T. WHEELER.

WILMA T. DONAHUE has been appointed director of the Michigan Psychological Services of the Institute for Human Adjustment at the University of Michigan. Michigan Psychological Services is a facility for extending the uni-

versity's program in research, the training of professional workers and service in the field of clinical psychology.

WILLIAM E. HALL, assistant professor of psychology, Eastern Washington College of Education (Cheney), has a year's leave of absence to serve as associate professor of psychology at the University of Nebraska.

The degree of doctor of science was conferred on DONCASTER G. HUMM on June 23 by Bucknell University in recognition of his work on "The standardization and validation of the Humm-Wadsworth Temperament Scale and its application to over three million industrial workers."

HERBERT H. HUMPHREYS, formerly assistant professor of psychology, Michigan State College, has accepted a position as assistant professor of psychology at the University of Kentucky.

HUDSON JOST, who has been research associate in psychophysiology at the Mooseheart Laboratory for Child Research at Mooseheart, Illinois, has been appointed assistant professor, department of neurology and psychiatry, and director of the psychophysiological laboratory of the Medical School, University of Tennessee, Memphis.

BRUNO KLOPFER will join the staff of the City College of New York as associate professor in the Fall of 1945. A program of graduate courses in the Rorschach method and other projective techniques to be given by Dr. Klopfer and his associates is being instituted in the graduate department of psychology at the City College.

MABEL F. MARTIN joined the staff of the Wichita Guidance Center August 1 as consulting psychologist, and FRANCENA L. PEARSON from the University of Iowa was appointed to a psychological examiner internship at the Center.

FANNIE D. MONTALTO has been appointed assistant clinical psychologist in the department of psychiatry, College of Medicine of the University of Cincinnati and in the Central Clinic of the Cincinnati General Hospital.

L. A. PENNINGTON has been released from active duty by the Navy and has returned to his position at the University of Illinois.

MALCOLM G. PRESTON of the department of psychology, University of Pennsylvania, has been appointed to the staff of the School of Social Work of the University of Pennsylvania which has recently become one of the coordinating professional schools of the University.

WILBERT SCOTT RAY, chairman of the department of psychology, Adelphi College (Garden City, N. Y.) is serving in one of the European school centers for American servicemen.

BRITTEN L. RIKER has been appointed assistant professor of psychology at the University of Vermont.

MERRILL ROFF, Major AC, Hq. AAF, who has been released from the Army returns to his position in the department of psychology, Indiana University, Bloomington, Ind.

JOHN P. SEWARD has resigned his position at Connecticut College and has accepted an associate professorship in psychology at the College of Liberal Arts, Boston University.

GEORGENE H. SEWARD has resigned her position at Connecticut College and has joined the faculty of Simmons College, Boston.

GEORGE D. SMALL, dean of men, Kansas State Teachers College (Pittsburgh), has been appointed dean of men and instructor in psychology, University of Tulsa.

DONALD W. TAYLOR of the Radio Research Laboratory, Harvard University, has been appointed acting assistant professor of psychology and Thomas Welton Stanford Fellow at Stanford University. War conditions permitting, he will assume his duties at Stanford in January, 1946.

HOMER E. WEAVER, assistant professor of psychology, Oberlin College (Oberlin, Ohio), has been advanced to an associate professorship.

M. A. WENGER, Lt. (jg.), USMS TS, has been appointed assistant professor of psychology at the University of California, Los Angeles.

S. MEDFORD WESLEY has been appointed to take charge of the psycho-educational clinic at the University of Southern California.

The Hennepin County Welfare Board, Minneapolis, Minn., has started operating the Vince A. Day Center, a home for children in which children will be placed temporarily for study and treatment before permanent placement. VIRGINIA H. BIXLER, of the Council of Social Agencies is superintendent, CHARLOTTE PHILLEO, formerly psychologist with the Division of Public Instruction of the State of Minnesota, is assistant superintendent, and AUDREY R. ARKOLA is girls' counselor.

The Metropolitan Life Insurance Company has published a booklet *Coming Home*, intended for the families and friends of returning servicemen. This pamphlet was prepared by the Company with the cooperation of the OWI and utilizes the information and experience of the Army Air Forces Convalescent-Rehabilitation program. Copies may be obtained free of charge from the Metropolitan Life Insurance Company, One Madison Avenue, New York City.

The publication, *Jobs for G.I. Joe in America's Hotels*, published by the Veterans Employment Program of the American Hotel Association, 221 West 57th Street, New York 19, N. Y., is a description of the physical demands of jobs within the hotel industry, and will probably be useful as a reference manual to rehabilitation counselors, who can obtain copies through the American Hotel Association.

The AC Spark Plug Division of General Motors Corporation, Flint, Mich., has published a booklet entitled *The Use of Tests in Proving Personnel Procedures*, by ORLO L. CRISSY, industrial psychologist and educational director, which gives brief descriptions of some of the selection procedures used in that division and validations with supervisors' ratings.

Southern California Psychological Association. A regional psychological association has been organized in Southern California to be known as the Southern California Psychological Association. The following are the officers of the new association: *President*, ROY M. DORCUS, *Vice-President*, FLOYD L. RUCH, *Secretary-Treasurer*, GILBERT BRIGHOUSE, *Directors*, HILDING B. CARLSON, HARRY W. CASE, JOSEPH W. HAWTHORNE, LOUIS P. THORPE, LEE EDWARD TRAVIS and DONALD P. WILSON.

Officers of the IAAP. The new officers of the Illinois Association for Applied Psychology are: *President*, PHYLLIS WITTMAN, chief psychologist of the Mental Hygiene Division of the Department of Public Welfare of the State of Illinois; *Vice President*, FRANCIS W. HIBLER, supervisor of Industrial Psychological Services of Stevenson, Jordan and Harrison, Inc.; *Secretary*, MILTON A. SAFFER, psychologist of the Bureau of Child Study and director of the Psychological Guidance Center in Chicago; *Treasurer*, STANLEY S. MARZOLF, associate professor of psychology at Illinois State Normal University; *Members-At-Large of the Executive Committee*, ADAM R. GILLILAND, professor of psychology at Northwestern University; HELEN SCHACTER, chief psychologist of the Veterans' Rehabilitation Center in Chicago, and HAROLD C. TAYLOR, employment manager of the Western Electric Company.

M.S. in Clinical Psychology at Illinois. The Board of Trustees of the University of Illinois on March 13, 1945, approved the recommendation of the University Senate, that the degree of Master of Science in Clinical Psychology be established to be conferred upon students meeting the following requirements: (a) Completion of undergraduate work sufficient to qualify for full graduate standing in psychology. This work shall include at least one course each in statistics, child psychology, and clinical psychology, and a total of not less than sixteen hours of psychology. (b) Completion of eight units of graduate work, with not less than four units in psychology, and not less than two units to be chosen from education and sociology (or other department upon recommendation of the department of psychology and the approval of the Dean of the Graduate School). (c) Completion of an internship consisting of six calendar months of supervised clinical experience at the Institute for Juvenile Research (or other institution, agency, or department, upon recommendation by the department of psychology and the approval of the Dean of the Graduate School).

Research in the Psychological Corporation. At the April meeting of the Board of Directors of the Psychological Corporation a new plan was adopted for the promotion of research in the Corporation and thus for the furtherance of the Corporation's basic aim, *The advancement of psychology and the promotion of its useful applications.* Each of the Corporation's five Divisions will set aside in each four-month fiscal period such a sum for research as is justified by the net income of the Division in the preceding fiscal period. The researches will be planned and controlled by the Directors of the Divisions, separately, or in co-operation, or in consultation with the General Manager or the Committee on Research, or perhaps at times by specially appointed research associates. The Committee on Research will be available for consultation, and will receive at the end of each fiscal period reports from the Divisions on the research accomplished and the money expended for it. This Committee consists, in its initial appointments, of J. G. JENKINS, R. S. WOODWORTH, and D. B. LUCAS. Research projects in the Corporation can also be supported from the general funds of the Corporation.

Correction: In the article by WM. D. ALTUS, "The Adjustment of Army Illiterates," pp. 461-76, July issue of the *Psychological Bulletin*, there are two errors as follows: p. 467, 1st line, 2nd paragraph, "tetrachoric correlation is .52," should be "tetrachoric correlation is .54; p. 471, 4th line, 3rd paragraph, "items 5, 6," should be "items 4, 5."

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